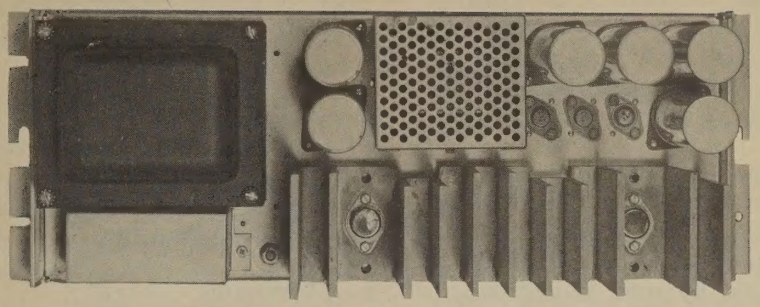

MODEL	APPLICATION
TPN1095A	Intermittent Duty, Remote Control Stations
TPN1096A	Continuous Duty, Remote Control Stations
TPN1102A	Intermittent Duty, Local Control Stations

1. DESCRIPTION TPN1106

These high efficiency, "variable duty cycle" power supplies provide A+, high current A+, audio A+ (all at 13.8 volts dc), and 9.6 volts dc to power the station. Current limiting, short circuit protection and over-voltage protection are provided.

2. THEORY OF OPERATION

"Switching" type regulation is incorporated in these power supplies. That is, an unregulated dc voltage is switched on and off to create dc pulses. These pulses are "averaged" into a lower dc voltage than was applied. The pulse width and the rate of pulse occurrence (and filtering) determines final output voltage. High current transistor switches are used to create these pulses and are controlled by power supply control circuitry that monitors output voltage and output current. Therefore, the power supply can be thought of as consisting of two "parts", switching and filtering, and switching control. The power supply schematic diagram must be referred to during the following discussion.

a. Switching and Filtering

(1) Input

Ac power is applied to the power supply from the ac line plug across voltage dependent resistor (VDR), RV1001 and spark gap E1001. This transient suppression circuit prevents high voltage transients that may appear on the AC line from damaging the power supply or station. When the transient exceeds approximately 350 volts, spark gap E1001 conducts. At this voltage, the VDR is a low resistance and the transient is effectively shunted from line to line. As the transient voltage decays, the VDR resistance increases to its former value, limiting the total current through the spark gap to a safe value. When the AC line voltage passes through zero the spark gap is extinguished and the protection circuitry is "reset" for another transient.

A full wave bridge rectifier consisting of diodes CR1001, CR1002, CR1003, and CR1004 provide the rectification that creates approximately 60 volts dc at input filter capacitors C1006 thru C1009. This is an unregulated source from which

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power is drawn in pulses to create the regulated output of the power supply.

(2) Crowbar SCR

Silicon controlled rectifier, SCR1001, shorts the 60 volts dc on the input filter capacitors to ground should power supply output attempt to rise above 16.0 volts. This causes fuse F1002 to blow which shuts down the power supply.

The gate (control lead) of the SCR is connected to a crowbar trigger circuit located on the power supply regulator circuit board. When a positive voltage is applied to the gate of SCR1001, it turns on which shorts the 60 volts to ground.

(3) Power Switch and Drivers

When power switches Q1001 and Q1002 are on, power is transferred from the unregulated 60 volt source to the power supply output filtering circuits.

Q1001 and Q1002 are turned on when a positive potential is routed from the variable width monostable on the 13.6-volt regulator circuit board to predriver, Q1005. When Q1005 turns on, a low is applied to switch drivers Q1003 and Q1004 which then also turn on. Now a high is applied to the bases of Q1002 and Q1001 which turn on. When the positive potential from the variable width monostable disappears, all these transistors turn off preventing dc input power from reaching the dc output filter stages. Therefore, the rate and duration of the pulses from the variable width monostable determine the amount of power delivered to the power supply output filtering stages.

(4) Output Filtering Stages

A "free wheeling" diode, CR1008 (and CR1007 when the power supply is used in continuous duty stations), and choke input filter stage consisting of choke L1001 and capacitor C1011 provide initial output filtering (or integration) of the switched dc pulses. When the power switches conduct, C1012 and C1013 charge positively. When the power switches stop conducting, CR1008 (and CR1007 if used) conduct and energy "stored" in L1001 is applied to the load which results in very high power supply efficiency.

Capacitor C1011 is a high frequency bypass capacitor that aids in eliminating high frequency components generated by power supply switching. Resistor R1011 is a "bleeder" resistor and provides a minimum load to the supply. Shunt resistor, R1013, is a current sensing resistor used in conjunction with the current limiter circuit described later. Capacitor C1018 reduces output impedance of the power supply at audio frequencies.

High current A+ is available to the transmitter power amplifier from the high current filter. Lower current filtered A+ and A+ are available to power the reset of the station from the low current filter section. Regulated +9.6 V is available from the 9.6-volt regulator.

b. Switching Control

(1) Variable Width Monostable

The variable width monostable determines the duty cycle of the power supply by determining the length of time the power switch transistors are allowed to conduct. As ac line voltage or load changes occur, the monostable output pulse width is altered to compensate for resultant changes in the dc input to the power switches.

Four conditions govern operation of the variable width monostable.

First, 6.8 volts must be present from either the start or run 6.8 volt sources to permit monostable operation. Second, when the power supply is first turned on, positive going pulses are applied to the base of Q1028 from the 20 kHz astable to trigger the monostable for a period of time which is determined by capacitor C1052 and resistor R1066. Third, after the power supply output voltage increases, a forward bias voltage is fed to the base of control transistor Q1030. This voltage is derived from and is proportional to the output voltage and controls the pulse width. Fourth, current is ultimately supplied to the collector of emitter follower driver. Q1031, through resistor R1070 and diode CR1039 once the power supply is running.

Before drive pulses are received from the 20 kHz astable, Q1028 is off and Q1032 is on. When a positive going pulse is received from the 20 kHz astable, Q1028 turns on and Q1032 turns off for a period of time determined by capacitor C1052, resistor R1066, and control transistor, Q1030. Control transistor Q1030 and its emitter resistor R1065 are in parallel with resistor R1066. The more Q1030 conducts, the lower its emitter to collector resistance becomes, thus lowering the RC time constant of C1052, R1066, and Q1030

which causes the monostable pulse width to decrease. Q1030 is driven by the voltage regulator and controls the duty cycle of the power switches. Therefore, the power supply output voltage stabilizes at a point determined by the setting of the OUTPUT VOLTAGE ADJUST control. Any tendency toward an increase in power supply output voltage is counteracted by decreasing the width of the monostable output pulse and any tendency toward a decrease in power supply output voltage is counteracted by increasing the width of the monostable output pulse. Pull-up transistor, Q1029 insures that capacitor C1052 is completely recharged by the time each succeeding pulse is received from the 20 kHz astable. Emitter follower transistor, Q1031, provides the drive to predriver transistor, Q1005, and isolates the effects of power switching from the monostable.

(2) 20 kHz Astable

The 20 kHz astable determines the rate at which the power switches turn on by controlling the rate at which pulses are delivered to the variable width monostable. Power switch conduction period is determined by the variable width monostable as described previously. The 20 kHz astable is basically a free running multivibrator that runs at a frequency of from 500 Hz to 20 kHz, depending on the "state" (start or run) of the power supply.

Three conditions govern operation of the 20 kHz astable. First, A+ must be applied through resistor R1058 from either the start or run 6.8 volt sources to permit astable operation. Second, when the power supply is in the start mode, the start sweep control causes the 20 kHz astable to start oscillating at 500 Hz and gradually rise to 20 kHz. Third, the load to the power supply must not present a short (less than .4 ohm) or the sweep control circuit will prevent the astable from sweeping up to 20 kHz. There is no power supply output while the 20 kHz astable is not running and only a very limited output when it is running at 500 Hz.

During a power supply start attempt, +6.8 volts is supplied from the start 6.8 volt source for approximately 2-1/2 seconds. When the start attempt begins, the 20 kHz astable runs at 500 Hz since only capacitors C1047 and C1049 and resistors R1050 and R1054 determine the switching rate. As power supply output voltage increases, astable control transistor, Q1025, begins to conduct which increases the frequency of the astable. The more the astable control transistor is driven into conduction, the lower the astable RC time constant and the higher its frequency. When the astable control transistor is ultimately driven into saturation, the frequency of the astable is 20 kHz. After approximately one to two seconds from the beginning of the start attempt, the supply reaches its run state and +6.8 volts to the astable is supplied from the run 6.8 volt source. Pull-up transistors, Q1023 and Q1026, allow rapid recharge of capacitors C1047 and C1049 as the astable is switching.

(3) Start Sweep Control

The start sweep control prevents overdissipation of the power switches during a normal start condition and when the supply is attempting to start into a short circuit. It also determines the maximum load into which the power supply will start. The start sweep control accomplishes this limiting action by holding the frequency of the 20 kHz astable to 500 Hz until the supply output voltage rises above a pre-determined level and by then gradually increasing the frequency to 20 kHz. Note that until normal output voltage is reached, the variable width monostable will produce its maximum pulse width (approximately 35 microseconds). This necessitates limiting the duty cycle of the power switches until the extreme load presented by uncharged output-filter capacitors or a short circuit is no longer present.

Comparator Q1036 establishes the output voltage at which the sweep from 500 Hz to 20 kHz will begin. Q1036 base voltage is controlled (via CR1043) by the supply output voltage and its emitter bias is derived from the input dc voltage. During the initial (500 Hz) period of a start attempt, the rising output voltage allows Q1036 to turn on. This turns on switch Q1035 via inverter, Q1037. When Q1035 conducts, C1048 charges through R1080 gradually turning on control transistor. Q1025, in the 20 kHz astable which "sweeps" the astable from 500 Hz to 20 kHz in approximately one second.

The time at which sweep occurs after the beginning of the start attempt varies with load. At light loads, sweep begins almost immediately. At maximum load, it may take up to two seconds to begin to sweep. An excessive load will not allow the output voltage to rise high enough during the start attempt period to begin the sweep.

(4) Start Clock Astable

The start clock astable regulates the times when the power supply will attempt to start after input power has been applied or when

overload condition exists. This circuit controls the start 6.8 voltage which is applied to the 20 kHz astable, variable width monostable, and start sweep control.

Assume Q1014 and Q1016 to be cut off when A+ is applied. Capacitor C1039 charges positively via resistors R1031, R1030, R1036, and diode CR1018 (providing a slight delay). Q1014 conducts and the power supply "start" attempt begins. Q1014 is on and Q1017 is off for approximately 2-1/2 seconds. This turns on emitter follower, Q1018, and driver, Q1019, and finally start 6.8 volts source transistor, Q1020, for the same interval of time. When Q1020 is on, start 6.8 voltage is created. Emitter follower, Q1018, is used to isolate the astable clock from its load.

Transistor Q1015 is functional with local control stations only and provides for power supply turn off (the power supply in remote control stations is always "on" as long as ac input power is applied). When the ON-OFF switch on the local control panel is in the OFF position, Q1015 is on which grounds the collectors of Q1038 and Q1016, turning them off. With Q1038 off, run 6.8 volts is disabled which turns off the power supply if it is already running. With Q1016 off, start 6.8 volts is disabled which prevents the power supply from turning on.

When the ON-OFF switch on the local control panel is in the ON position, a low is applied to the base of Q1015 which turns it off. With Q1015 off, the power supply turns on when ac input power is applied as with remote control stations.

(5) Start and Run 6.8 Volt Source - Run Short Circuit Protection

The start 6.8 voltage source and a run 6.8 voltage source are used as control voltages for the 20 kHz astable and variable width monostable. As the names imply, start 6.8 volts is available only during a start attempt and run 6.8 volts is available only after the power supply is running. The start 6.8 voltage is derived from the input dc voltage and provides 6.8 volts before power supply output itself is capable of providing run 6.8 volts.

When a start attempt begins, the start clock astable causes the start 6.8 volts switch transistor, Q1020, to turn on. This applies a positive voltage through diode CR1023 to the 6.8 volt Zener diode, CR1025. This voltage will be present for only about 2-1/2 seconds, at which time the start clock astable will cut off Q1020. If the power supply does not start (such as when an overload exists) the start clock astable will, after 1-1/2 seconds, again initiate a start 6.8 voltage. This recycling of start 6.8 voltage continues until the condition preventing start is corrected or until input power to the power supply is removed.

Run 6.8 voltage is derived from the output of the power supply and, when it is present, recycle of the start 6.8 voltage is inhibited.

When the power supply output voltage reaches approximately 10 volts, run 6.8 volts source transistor, Q1038, turns on which forward biases diode CR1024 and supplies current to Zener diode CR1025. Q1038 and its associated circuit form a constant current source; as more current tends to be drawn, more voltage is dropped across resistors R1088 and R1089, resulting in a decrease of forward bias; the base-to-supply voltage being clamped to a fixed value by diodes CR1044 and CR1045.

When run 6.8 voltage is created, the start 6.8 voltage source is inhibited due to a positive voltage applied to the base of start clock control transistor, Q1016. This turns off Q1014 allowing the start clock to complete its cycle but prevents a recycle. The run 6.8 voltage source provides instantaneous short circuit protection while the power supply is running. Should a short or overload cause the power supply output voltage to drop below 10 volts, the run 6.8 voltage is turned off which terminates the switching action of the power switch transistors and the power supply reverts to the start attempt mode.

(6) Voltage Regulator

The voltage regulator maintains power supply output voltage at the level set by the OUTPUT VOLTAGE ADJUST control during varying line voltage and load conditions. It maintains a constant output by controlling the width of each pulse from the variable width monostable except when the power supply is trying to start.

Power supply output voltage is monitored by detector, Q1039. The voltage on its base is limited to 6.8 volts by Zener diode, CR1047, but its emitter voltage is proportional to the output voltage. OUTPUT VOLTAGE ADJUST control, R1091, establishes the point at which power supply output voltage is maintained. Should output voltage tend to decrease due to an increased load, the emitter voltage on detector Q1039 decreases.

However, base voltage remains the same and, therefore, detector, Q1039, conducts less causing regulator, Q1040, to conduct less. This decreases the drive to monostable control, Q1030, in the variable width monostable, thereby increasing the pulse width. An increased pulse width causes power supply output voltage to tend to increase, thus counteracting the effect of the increased load.

Should the power supply output voltage tend to increase due to decreased load, the functions are similar -- detector, Q1039, and regulator, Q1040, conduct more resulting in more drive to monostable control, Q1030. The pulse width is decreased, and power supply output voltage tends to decrease -- counteracting the effect of a reduced load.

(7) Current Limiter

The current limiter protects the power supply from excessive current demands by causing power supply output voltage to drop when current exceeds a preset level (30 amperes). Note that, during overload conditions, the current limiter actually "takes over" control of power supply output voltage. Should the current demand be so great that power supply output voltage drops below 10 volts, run 6.8 volts disappears and the power supply reverts to the start attempt mode.

Output current is detected by the voltage drop across shunt resistor, R1013. This resistor is "across" both base inputs (pins 1 and 5) of differential amplifier, IC1001. The differential amplifier multiplies the small changes in voltage drop across R1013 so that little power is lost in current detection and regulation. CURRENT LIMIT ADJUST control, R1102, sets the current limit at which the current limiter begins to decrease power supply voltage output.

As supply output current increases, the voltage on the "input" side of R1013 remains nearly constant while the voltage on the "output" side of R1013 decreases. This results in a lowering of voltage on IC1001-5 while the voltage on IC1001-1 remains the same. Therefore, the voltage difference between the collectors of IC1001 (pins -6 and -8) increases. Pin 6 rises in relation to pin 8 under these circumstances. Therefore, Q1041 and Q1042 begin to conduct. The more Q1042 conducts, the lower its collector to emitter resistance becomes. This increases the voltage applied to the base of Q1040 in the voltage regulator which causes it to conduct more. As described during the discussion of the voltage regulator, the more Q1040 conducts, the lower power supply output voltage will be.

(8) Start Short Circuit Protection

This circuit prevents the power supply from being damaged should a short-circuit load (less than 0.4 ohm) be applied during power supply start up. Short circuit protection after the power supply has reached rated output is accomplished by the removal of run 6.8 voltage. Since run 6.8 voltage is present only in the run mode, it cannot provide protection against shorts during start up.

Once start sweep has begun, power supply output voltage steadily increases from 0 volts to rated 13.8 volts in about one second during which time the switching rate of the power switches steadily increase. Switch, Q1034, is enabled during the start attempt period and the output voltage of the power supply is monitored by the start short circuit protection circuit at detector, Q1033. As power supply output voltage rises, the emitter and base voltage at detector, Q1033, will rise at the same rate and the detector remains off. Capacitor C1053 also charges positively through diode CR1040 as the supply output voltage rises. However, when the supply output is shorted, output voltage drops to zero. The emitter voltage on detector, Q1033, drops to zero and diode CR1040 back-biases. Now, capacitor C1053 holds the base of the detector positive momentarily and the transistor conducts. When detector, Q1033, conducts, switch, Q1034, also conducts applying a positive voltage pulse to the base of Q1027 in the 20 kHz astable momentarily stopping the astable, and locking on Q1033 via R1076 and CR1041 preventing further drive to the power switches. Since the short circuit protection circuit provides only a momentary "freeze" in switching action, the power supply will attempt to start again after a few moments providing input power is still applied.

(9) Crowbar - Overvoltage Protection

The crowbar circuit consists of an SCR and controlling components. This circuit insures that excessive output voltage cannot occur to cause possible damage to the station. Should the power supply output voltage reach 16 volts, the crowbar SCR "fires" and fuse F1002 blows shutting down the power supply.

As power supply output voltage increases, a sample of that voltage is routed to Q1022 of the crowbar trigger circuit. The voltage applied to the base of Q1022 is prevented from rising higher than approximately 15 volts by Zener diode CR1026. The voltage on the emitter of Q1022,

however, is permitted to follow the rise in output voltage so that, when the output voltage approaches 16 volts, the transistor turns on which switches a positive voltage to the base of Q1021 which then also turns on. A large, positive going pulse is then fed to the gate of crowbar SCR1001 which turns it on. Once the silicon controlled rectifier is on, it shorts the output of the rectifier bridge preventing any further rise in output voltage by blowing the line fuses.

(10) ±9.6 Volt Regulator

9.6 volts is developed by a voltage sensing regulator circuit that regulates the current through series-pass transistor Q1006. The A+ input has a current path through Q1006 to the external load. Transistors Q1007 and Q1008 provide the voltage regulation circuit. Regulation is achieved by changing the Q1006 base current in the proper direction; increasing it if the output voltage decreases and decreasing it if the output voltage increases. Output voltage is sensed by 8.2-volt reference Zener diode CR1011 which allows increased drive to Q1008 as output voltage increases which, in turn, decreases the drive to Q1007. With Q1007 conducting less, less drive is applied to series-pass transistor Q1006 and output voltage decreases proportionally. On the other hand, as output voltage decreases, the exact opposite occurs. Zener diode CR1011 senses less voltage and, ultimately, the drive to series-pass transistor Q1006 is increased which raises output voltage proportionally.

3. START SEQUENCE

a. Introduction

The following discussion should be used only after power supply terms are understood as described in the previous Theory of Operation paragraphs. A condensation of power supply terms is given in the maintenance area of this section, under Troubleshooting. Refer to the power supply schematic and block diagrams.

b. Events

(1) AC power applied.

(2) DC voltage at C1006 rises to 60 volts.

(3) After approximately 1/2 second, start clock turns on start 6.8 voltage source and start attempt begins.

(4) 20 kHz astable runs at 500 Hz.

(5) Variable width monostable delivers maximum pulse width to the power switches at a 500 Hz rate.

(6) Supply output voltage begins to rise.

(7) Start sweep control senses normal load and sweeps 20 kHz astable from 500 Hz to 20 kHz.

(8) As output voltage rises to the preset value, the voltage regulator takes control of the variable width monostable and adjusts pulse width to maintain constant output voltage over varying line voltage and load conditions. Run 6.8 voltage replaces start 6.8 voltage.

4. LEVEL SET ACCESS AND ADJUSTMENTS

a. Output Voltage Adjust Control Access

(1) Loosen the seven screws securing the large perforated back cover on the filter section.

This exposes the OUTPUT VOLTAGE ADJUST and CURRENT LIMIT ADJUST which are controls identified on the power supply 13.8 V regulator circuit board detail at the end of this section.

b. Output Voltage Adjustment

The OUTPUT VOLTAGE ADJUST control is identified on the power supply identification photo located in this power supply section.

CAUTION

Do not turn the OUTPUT VOLTAGE ADJUST control to either extreme position except as required during troubleshooting.

Full counterclockwise rotation will cause output voltage to drop to a point where the power supply will not run but will continuously recycle through start attempts. Full clockwise rotation causes the overvoltage protection circuit to blow the ac line fuse.

(1) Connect a dc voltmeter with less than 3% error (refer to the list of recommended test equipment in the maintenance paragraphs) to the + and - DC terminals on power supply terminal strip TB1001.

(2) With the station in the standby mode, set the output voltage to 13.8 volts.

c. Current Limiter Test and Adjustment

This control is factory set to limit at 30 amperes and should not require routine re-adjustment. The function of the current limiter can be observed without disassembly of the station.

(1) Connect a variable load, voltmeter, and current meter (refer to maintenance section for list of recommended test equipment) to the + and - DC terminals on power supply terminal strip TB1001.

(2) Set the load at maximum resistance and turn on the power supply.

(3) Gradually increase the load while observing output voltage and current.

When limit current is reached (approximately 29 amps in this case) the output voltage will begin to decrease significantly.

(4) Increasing the power supply load further causes the current to "fold back" to a lower value. Ultimately, the power supply will shut down and begin repeated attempts to start. Decreasing the load at this point allows the supply to restart.

NOTE

Readjustment is not necessary unless the limiting current is more than 2 amperes, high or low. CHECK FOR PROPER ADJUSTMENT OF THIS CONTROL BEFORE ATTEMPTING READJUSTMENT.

(5) If a current of 32 amperes is reached with no limiting action, do not increase the load further. Instead, turn the LIMIT CURRENT ADJUST control counterclockwise until limiting action appears.

(6) This completes the adjustment procedure.

5. MAINTENANCE

a. Introduction

Maintenance and repairs of this power supply demands a thorough understanding of its operation. Refer to the power supply Theory of Operation for this information.

b. Test Equipment Required

The following test equipment is necessary for efficient, accurate servicing in the event that maintenance is required.

(1) DC voltmeter (Motorola Model T1022A, or equivalent).

(2) Ohmmeter (Motorola Model T1022A, or equivalent).

(3) DC current meter (0-35 amperes).

(4) Load resistor (variable from 0.3 ohm to 15 ohms, and capable of carrying 30 amperes).

(5) Variable voltage ac line transformer (0-130 volts).

(6) Oscilloscope (Motorola Model S1331A, or equivalent).

c. Disassembly

Figures 1 through 8 describe the access procedure to all power supply circuit boards and "areas". Access can be made to the areas with the power supply mounted in the station.

NOTE

The power supply weighs approximately 50 pounds.

d. Troubleshooting

(1) Introduction

Eight major malfunction headings (conditions) are given after the introduction to troubleshooting. Unless otherwise noted, perform the tests with a full load (30 amps) connected to the high current output (+ and - terminals on TB1001 on the power supply) to the power amplifier. The resistance of such a load is approximately 0.45 ohms.

(2) Conditions

From the following eight major malfunction headings, select the one that describes the power supply malfunction. Follow the step-by-step check list to localize the trouble and identify the specific malfunction. Analyze the possible trouble using the schematic diagram with information given in the Theory of Operation paragraphs of this section.

CAUTION

When making measurements, be extremely careful not to create shorts or accidental connections which could cause power supply damage.

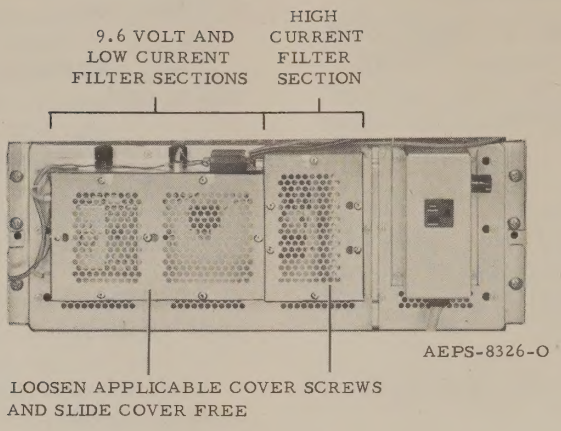
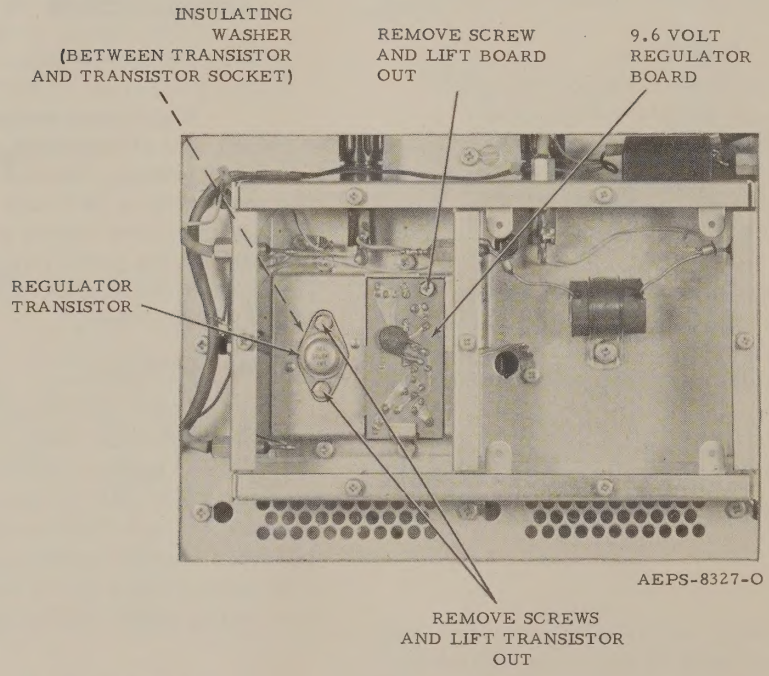
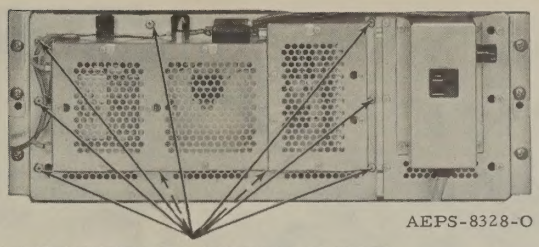


Figure 1.
Access to 9.6 Volt, Low Current,
and High Current Filter Sections



CAUTION
COAT BOTH SIDES OF INSULATING WASHER
WITH HEAT CONDUCTING SILICONE COMPOUND
BEFORE REPLACING THE TRANSISTOR.

Figure 2.
9.6 Volt Regulator Board
Removal and Regulator Transistor Replacement



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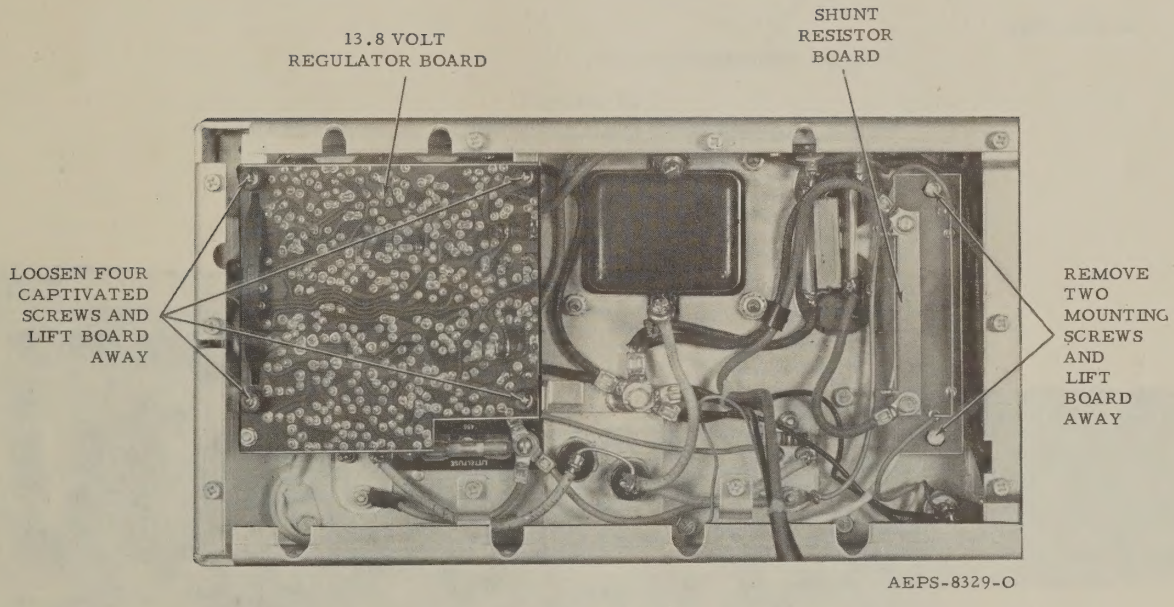
LOOSEN INDICATED SCREWS AND SLIDE COVER AND FILTER ASSEMBLY FREE

Figure 3.
Access to 13.8-Volt Regulator Board
and Shunt Resistor Board



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CAUTION

Do not remove or install this board with power applied. Always allow several seconds for capacitors to discharge after removal of power before extracting the board.

Figure 4.
Removal of 13.8-Volt Regulator Board
and Shunt Resistor Board

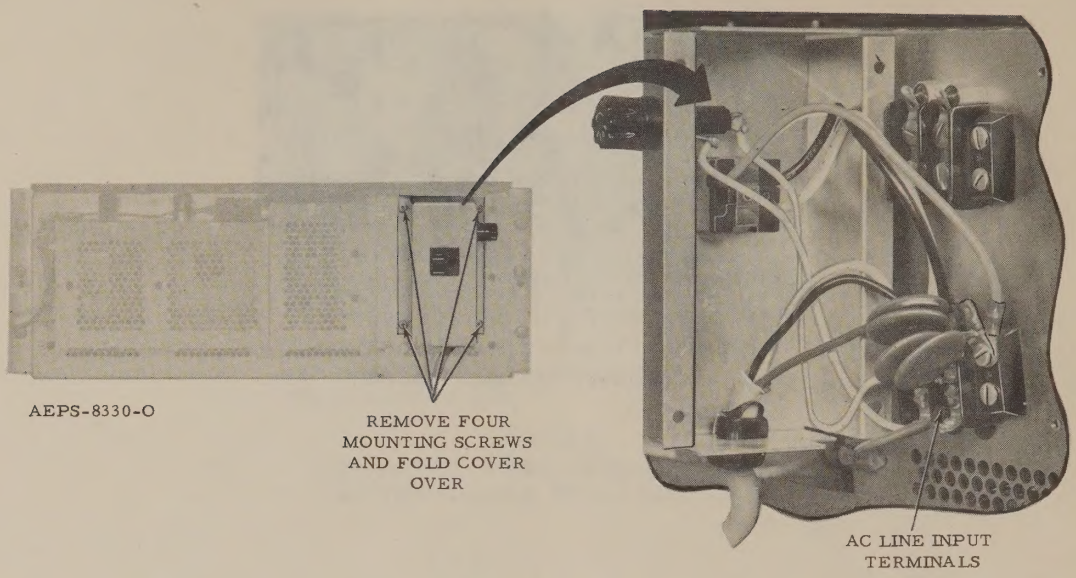


Figure 5.
Access to AC Line Input Terminals

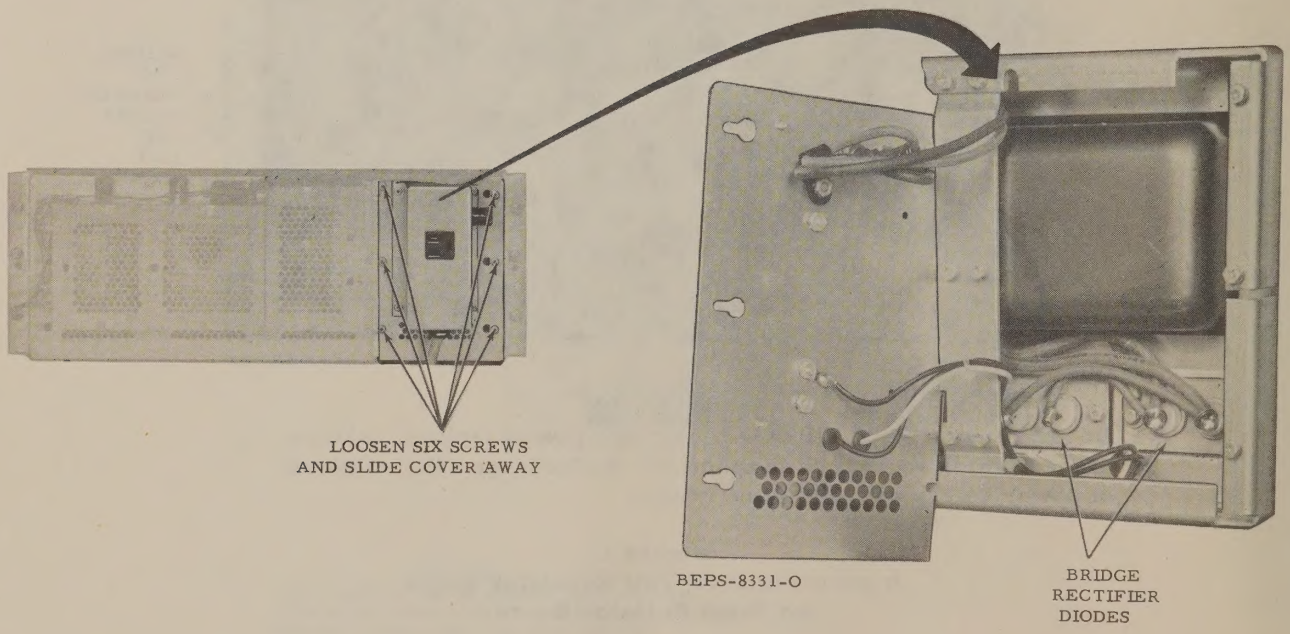


Figure 6.
Access to Bridge Rectifier Circuit

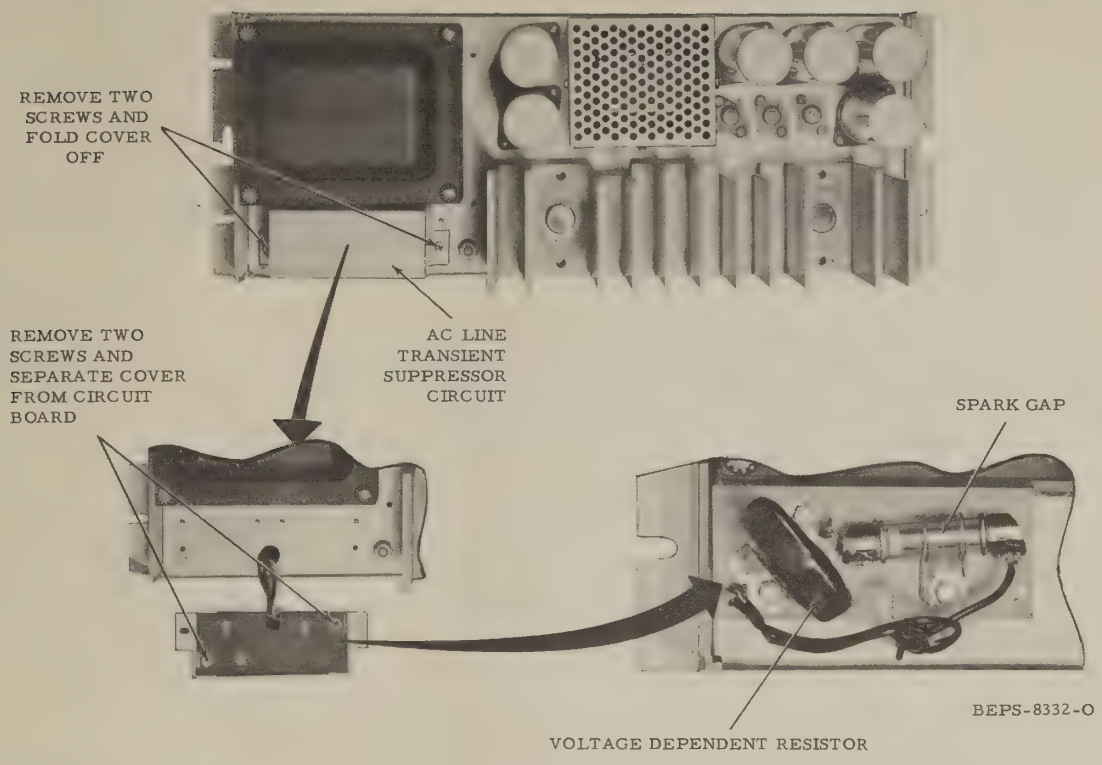
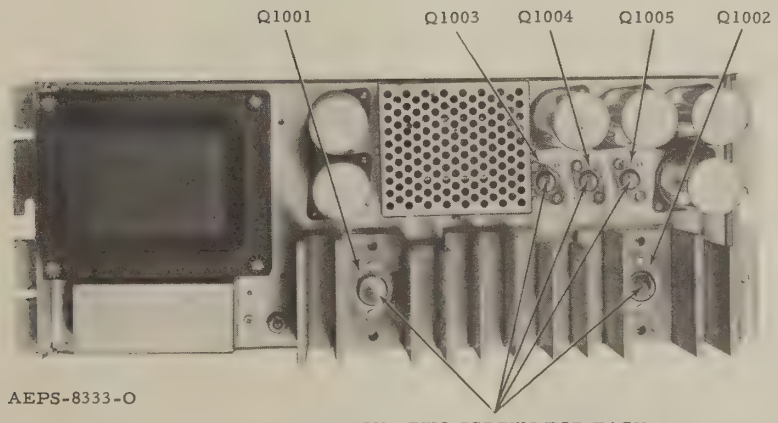


Figure 7.
Access to AC Line Transient Suppressor Circuit



CAUTION
EACH TRANSISTOR IS SEPARATED FROM ITS SOCKET BY AN INSULATOR. COAT BOTH SIDES OF THE INSULATOR WITH HEAT CONDUCTING COMPOUND BEFORE REPLACING THE TRANSISTOR.

Figure 8.
Chassis Mounted Transistor Replacement

Power supply terminology follows as an aid to using the troubleshooting information.

(a) Run

Power supply switching at 20 kHz and capable of full load with output voltage regulation.

(b) Sweep

The rapid increase in power supply switching frequency from 500 Hz to 20 kHz. This sweep is audible until it reaches 20 kHz.

(c) Start Attempt

Time interval when the start clock supplies start 6.8 V and supply switches at 500 Hz.

(d) Start

Start attempt followed by a sweep, leading to a run condition.

(e) Crowbar

Switching device used to purposely overload one circuit to protect others.

(f) Full Load

Thirty (30) amperes at 13.35 V dc.

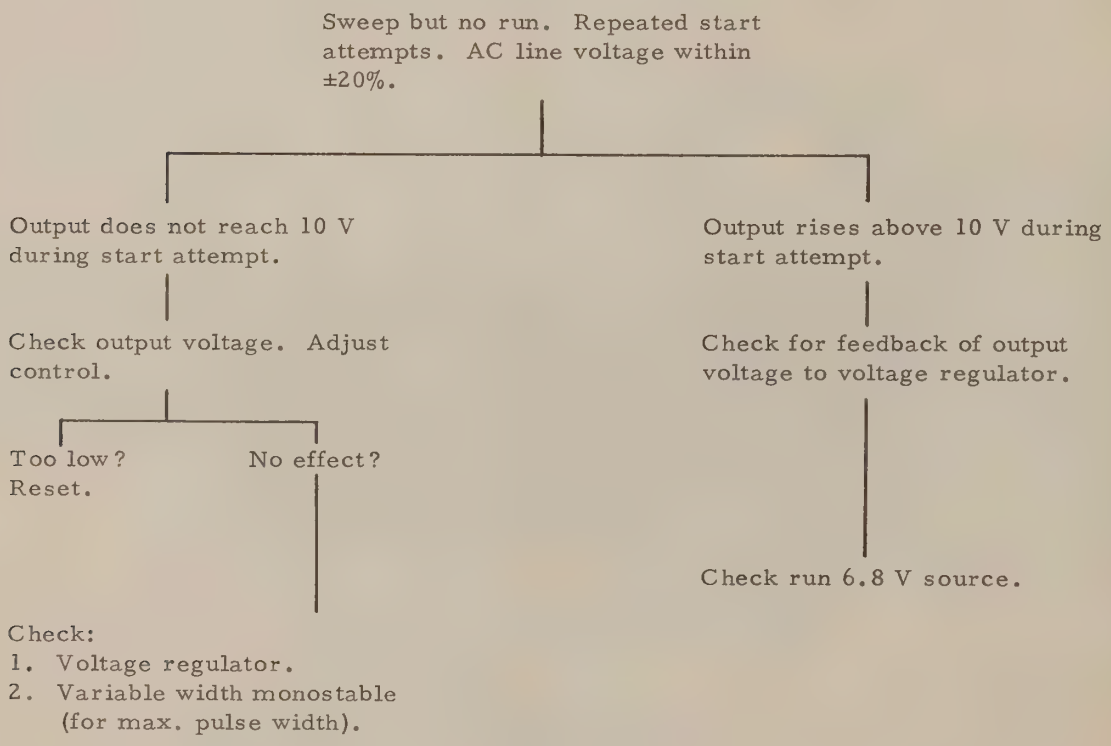
e. Testing Regulator Board (Independent of Power Supply Chassis)

(1) Connect a 60 V dc power source to the regulator board; (+) to pin 8 and (-) to pin 5.

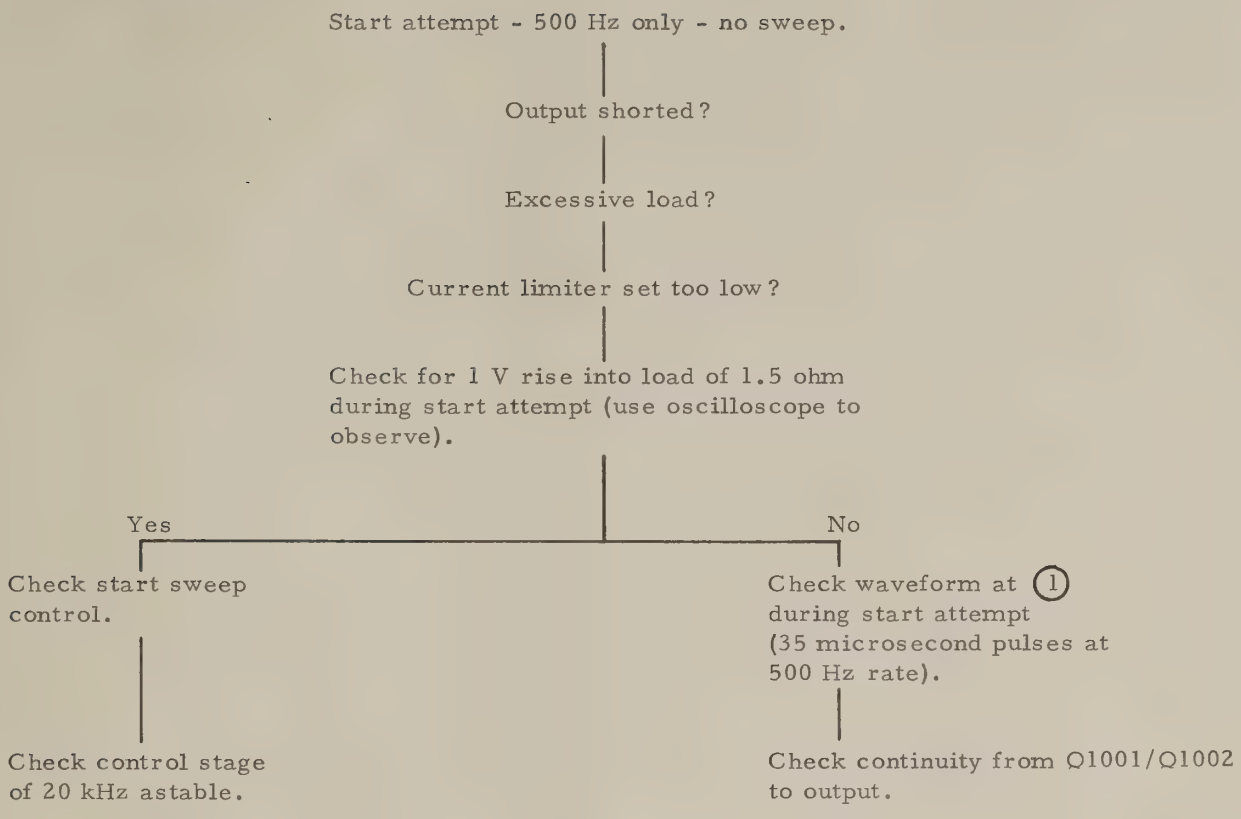
(2) Connect a 0-16 V dc power source to the regulator board; (+) to pins 2, 3, and 6; and (-) to pin 5.

The functions of all circuits on the regulator board (with the exception of the current limiter) can be checked by switching and varying these voltages according to the actions described in the power supply Theory of Operation paragraphs. Current limiter performance is best checked in an operating power supply.

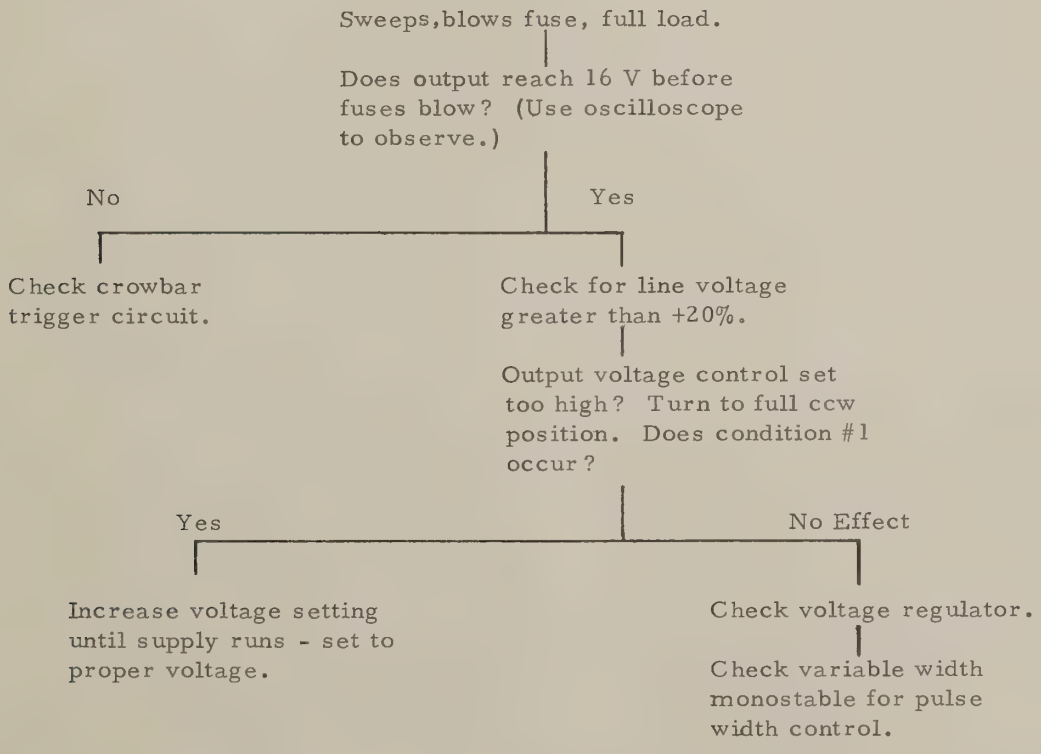
(a) Condition #1



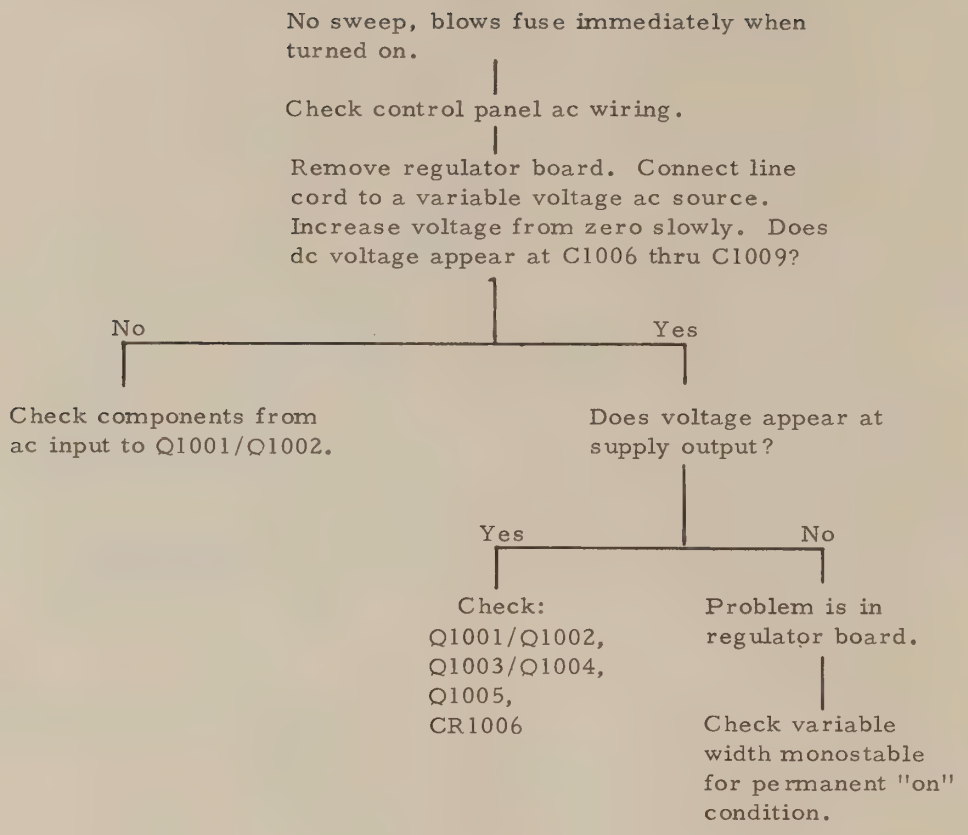
(b) Condition #2



(c) Condition #3



(d) Condition #4



(e) Condition #5

No start attempt -- fuses OK.

Check voltage at C1006 thru C1009.

Check start clock.

Check start 6.8 V. source.

Check 20 kHz astable.

Check variable width monostable.

Check Q1001 thru Q1005.

Check continuity from Q1001/Q1002 to output.

(f) Condition #6

Runs but output voltage is low.

Check setting of output voltage adjust control.

Check setting of current limit adjust control.

Check voltage regulator.

Check variable width monostable.

Check 20 kHz astable.

(g) Condition #7

Runs normally at no load, but output voltage drops at load.

|

Current limiter set too low -- readjust.

(h) Condition #8

Will start at no load but not at full load.

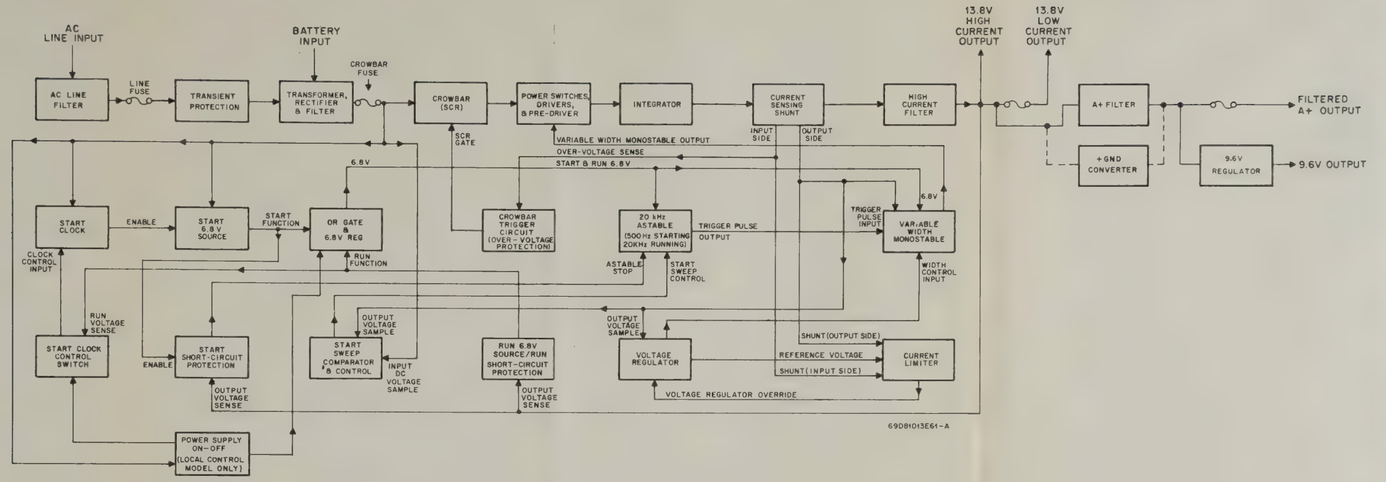
|

Check for low ac line voltage.

|

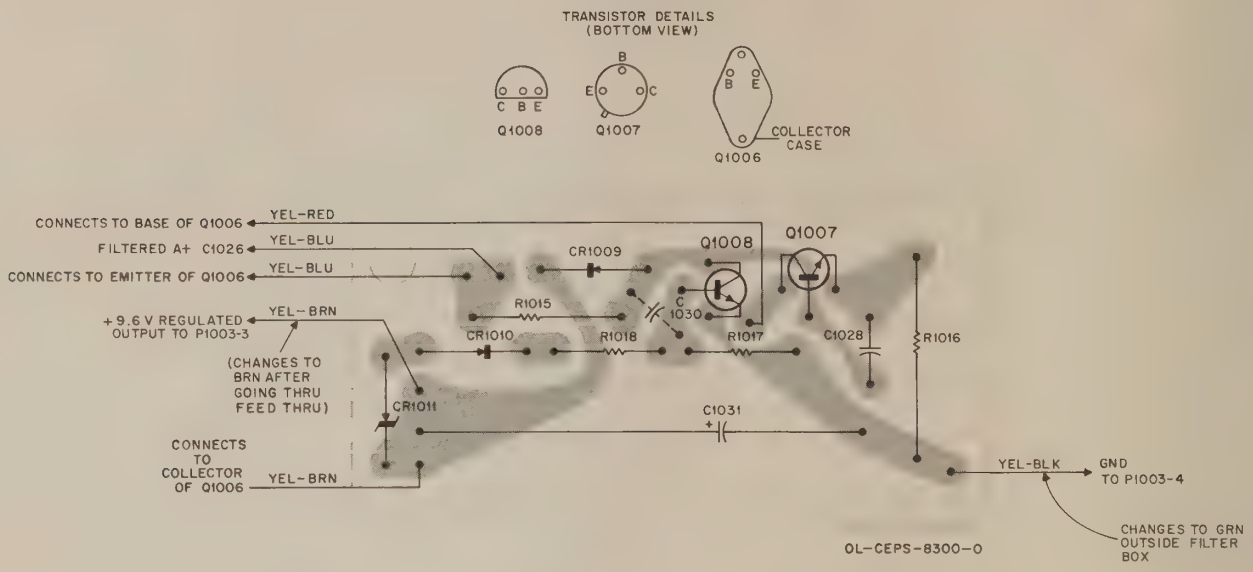
Check comparator of start sweep control.

Power Supply
Functional Block Diagram
Motorola No. 69D81013E61-A
6/12/74-UP



Power Supply
Functional Block Diagram
Motorola No. 69D81013E61-A
6/12/74-UP

9.6-VOLT REGULATOR BOARD



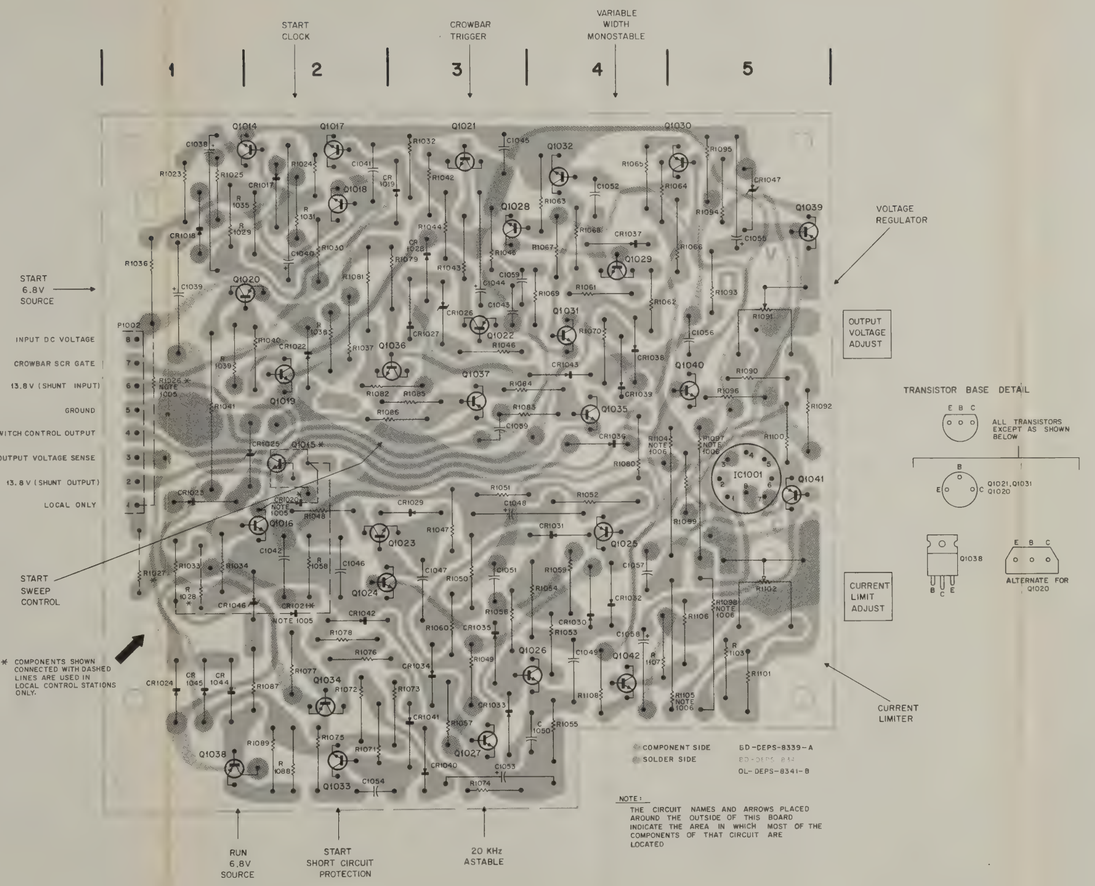
Power Supply
Schematic Diagram
Motorola No. 63P81015E01-E
11/21/74-UP

13.8 V REGULATOR BOARD COMPONENT LOCATIONS

REF. SYM.	LOCATION	REF. SYM.	LOCATION	REF. SYM.	LOCATION	REF. SYM.	LOCATION
C1038	A1	CR1046	C1	R1040	B1	R1090	B5
C1039	B1	CR1047	A5	R1041	B1	R1091	B5
C1040	A2	IC1001	C5	R1042	A3	R1092	B5
C1041	A2	P1002	B1	R1043	A3	R1093	B5
C1042	C2	Q1014	A1	R1044	A3	R1094	A5
C1043	B3	Q1015	C2	R1045	A3	R1095	A5
C1044	B3	Q1016	C2	R1046	B3	R1096	B5
C1045	A3	Q1017	A2	R1047	C3	R1097	B5
C1046	C2	Q1018	A2	R1048	C2		NOTE 1006
C1047	C3	Q1019	B2	R1049	D3		
C1048	C3	Q1020	B1	R1050	C3	R1098	C5
C1049	D4	Q1021	A3	R1051	C3		NOTE 1006
C1050	D3	Q1022	B3	R1052	C4		
C1051	C3	Q1023	C2	R1053	C4	R1099	C4
C1052	A4	Q1024	C2	R1054	C3	R1100	B5
C1053	D3	Q1025	C4	R1055	D4	R1101	D5
C1054	D2	Q1026	D3	R1056	C3	R1102	C5
C1055	A5	Q1027	D3	R1057	D3	R1103	D5
C1056	B5	Q1028	A3	R1058	C2	R1104	B4
C1057	C4	Q1029	A4	R1059	C4		NOTE 1006
C1058	D4						
C1059	B3	Q1030	A4	R1060	C3	R1105	D4
CR1017	A2	Q1031	B4	R1061	B4		NOTE 1006
CR1018	A1	Q1032	A4	R1062	B4		
CR1019	A2	Q1033	D2	R1063	A3	R1107	D4
CR1020	C2	Q1034	D2	R1064	A4	R1108	D4
CR1021	C1	Q1035	B4	R1065	A4		
CR1022	B2	Q1036	B2	R1066	A4		
CR1023	C1	Q1037	B3	R1067	A4		
CR1024	D1	Q1038	D1	R1068	A4		
CR1025	B1	Q1039	A5	R1069	A3		
CR1026	B3	Q1040	B5	R1070	B4		
CR1027	B3	Q1041	C5	R1071	D2		
CR1028	A3	Q1042	D4	R1072	D2		
CR1029	C3	R1023	A1	R1073	D2		
CR1030	C4	R1024	A2	R1074	D3		
CR1031	C4	R1025	A1	R1075	D2		
CR1032	C4	R1026	B1	R1076	D2		
CR1033	D3	R1027	C1	R1077	D2		
CR1034	D3	R1028	C1	R1078	D2		
CR1035	D3	R1029	A1	R1079	A2		
CR1036	B4	R1030	A2	R1080	C4		
CR1037	A4	R1031	A2	R1081	A2		
CR1038	B4	R1032	A3	R1082	B2		
CR1039	B4	R1033	C1	R1083	B3		
CR1040	D3	R1034	C1	R1084	B3		
CR1041	D3	R1035	A2	R1085	B3		
CR1042	C2	R1036	A1	R1086	B2		
CR1043	B4	R1037	B2	R1087	D1		
CR1044	D1	R1038	B2	R1088	D2		
CR1045	D1	R1039	B1	R1089	D2		

EPS-8635-A

13.8-VOLT REGULATOR BOARD

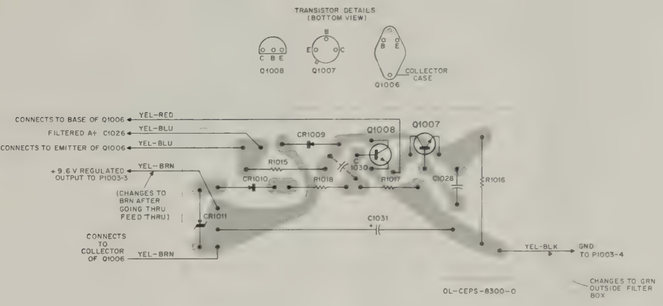


* COMPONENTS SHOWN CONNECTED WITH DASHED LINES ARE USED IN LOCAL CONTROL STATIONS ONLY.

TRANSISTOR BASE DETAIL

NOTE:
THE CIRCUIT NAMES AND ARROWS PLACED AROUND THE OUTSIDE OF THIS BOARD INDICATE THE AREA IN WHICH MOST OF THE COMPONENTS OF THAT CIRCUIT ARE LOCATED

9.6-VOLT REGULATOR BOARD



NOTES:

1001. CIRCLED NUMBERS INDICATE LOCATIONS AT WHICH TO OBSERVE WAVEFORMS ON AN OSCILLOSCOPE.

1002. VOLTAGES–
- A. FL = FULL LOAD (APPROX. 30 AMPS).
- B. NL = NO LOAD.
- C. VOLTAGES SHOWN IN PARENTHESIS ARE PRESENT DURING THE START ATTEMPT ONLY. ALL OTHERS ARE PRESENT DURING THE RUN CONDITION.
- D. VOLTAGES ARE TYPICAL AND DO NOT CHANGE SIGNIFICANTLY FROM LOAD TO NO-LOAD CONDITIONS UNLESS OTHERWISE INDICATED.
- E. ALL VOLTAGES ARE MEASURED WITH AN 11 MEGOHM INPUT RESISTANCE VOLTMETER IN RESPECT TO CHASSIS GROUND.

1003. UNLESS OTHERWISE STATED, CAPACITOR VALUES ARE IN MICRO-FARADS.

1004. UNLESS OTHERWISE STATED, RESISTOR VALUES ARE IN OHMS.

1005. R1026, CR1020, & CR1021 ARE MOUNTED ON SOLDER SIDE OF BOARD.

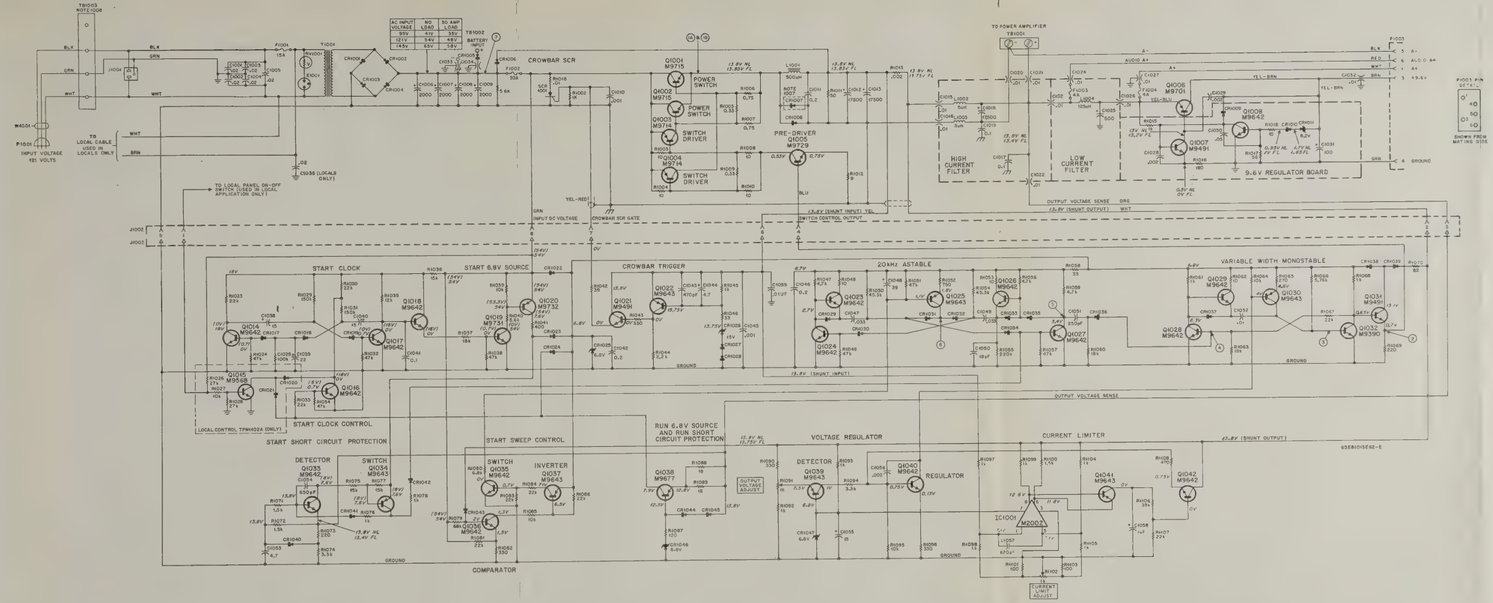
1006. R1097, R1098, R1104, & R1105 ARE A THICK-FILM RESISTOR NETWORK.

1007. CR1007 USED IN CONTINUOUS DUTY MODELS ONLY.

EPS-8593-A

REVISIONS 63P81015E01-E

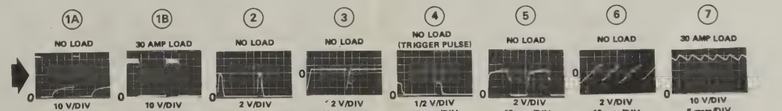
BOARD AND SUFFIX NO.	REF. SYMBOL	CHANGE	LOCATION
TLN4731A-1 & TLN4918A	C1054	WAS .0022 ±10%, 100 V PART NO. 21-82438B37	BASE-COLLECTOR OF DETECTOR Q1033
TPN1056A-1 TPN1102A-1 (TLN4918A-1)	C1059	ADDED 21-83596E21, .01 uF	CROW BAR TRIGGER CIRCUIT
TLN4731A-1 TLN4736A-1 TLN4935A-1	F1001	FROM 65-135013, 20 AMP, TO 65-139131, 15 AMP. FROM 6-84449D01, .004 TO 6-84449D02, .003	POWER INPUT
	R1013	DELETED 6-84449D01, .004, WAS CONNECTED IN PARALLEL WITH RESISTOR R1013.	13.8 V SHUNT OUTPUT
	R1014	ADDED	
	C1035		



OSCILLOSCOPE WAVEFORMS MEASURED UNDER FOLLOWING CONDITIONS:

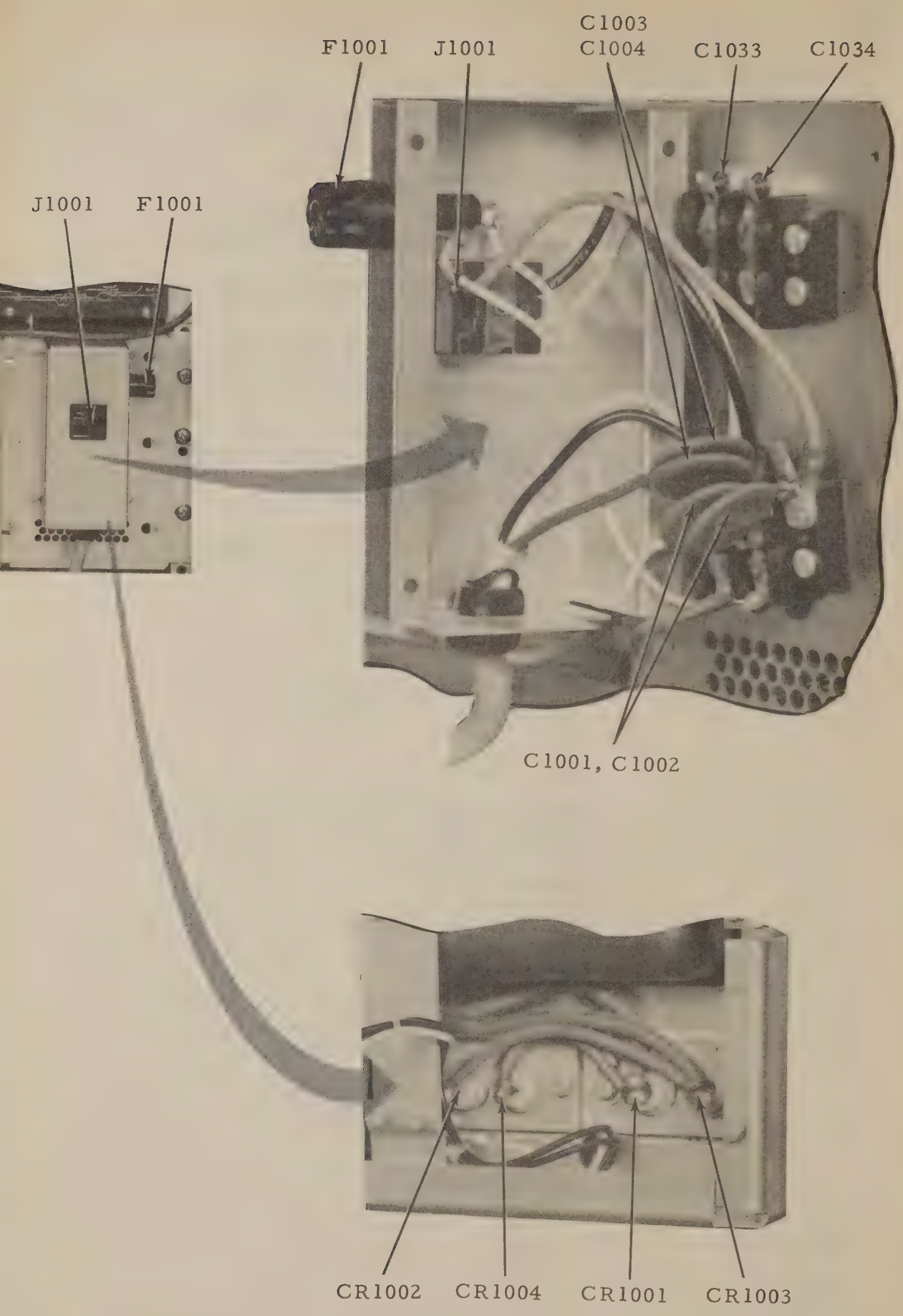
1. VERTICAL SENSITIVITY AND HORIZONTAL DEFLECTION, AND POWER SUPPLY LOAD CONDITION SHOWN WITH EACH WAVEFORM.
2. NOMINAL INPUT VOLTAGE APPLIED (121 V AC).

EPS-5945-O



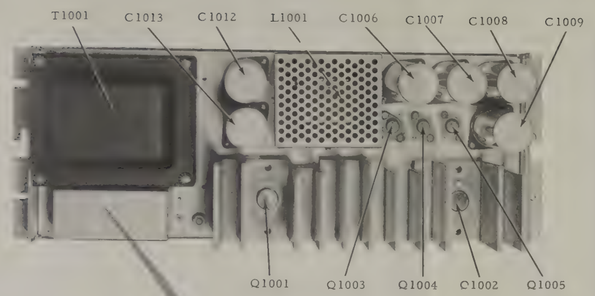
POWER SUPPLY

Power Supply
Schematic Diagram
Motorola No. 63P81015E01-E
11/21/74-UP

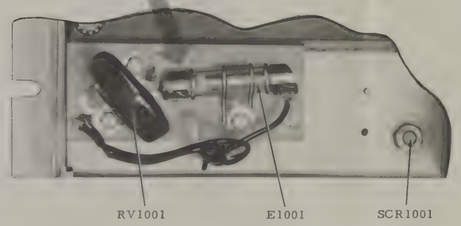

F1001
J1001
C1003
C1004
C1033
C1034
J1001
F1001
C1001, C1002
CR1002
CR1004
CR1001
CR1003

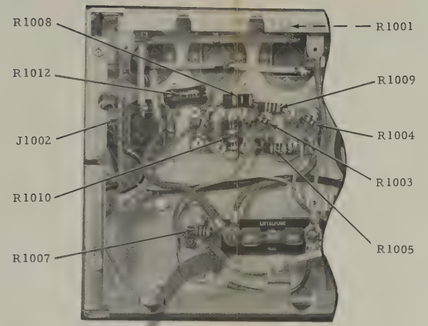
POWER SUPPLY

FRONT VIEW

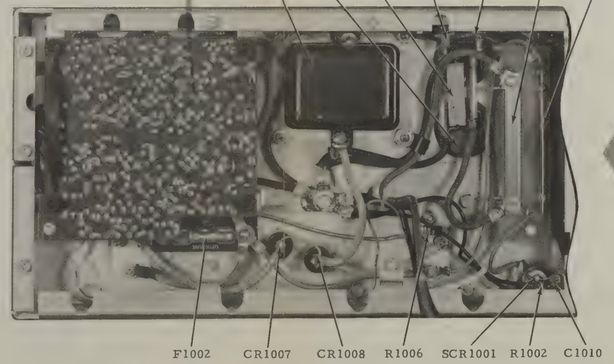


COVER REMOVED

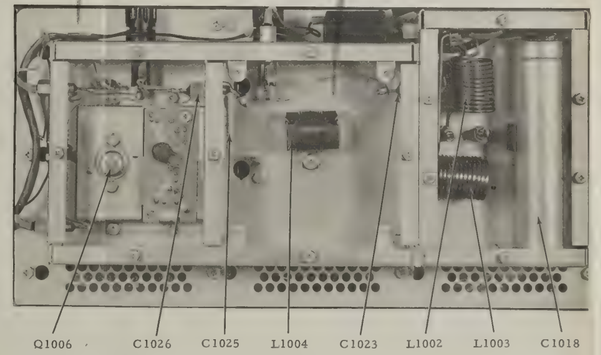




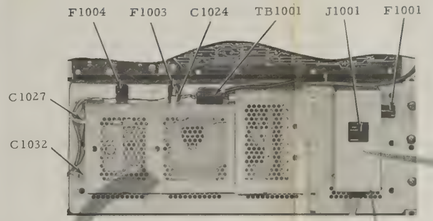
13.8 VOLT REGULATOR BOARD REMOVED



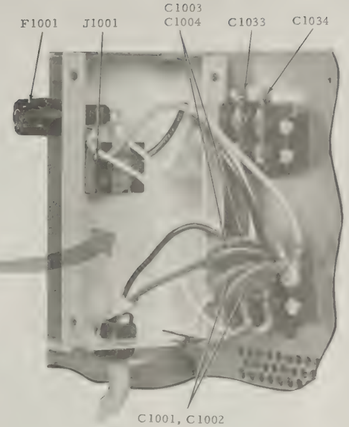
BACK SIDE

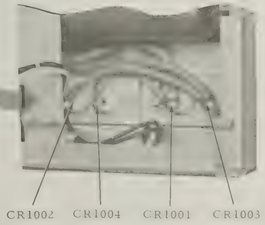


REAR VIEW



COVERS REMOVED





POWER SUPPLY

TLN4936A +13.8 V Regulator Board
(Local Control Applications) PL-1674-B

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
		CAPACITOR, fixed; uF ±10%; 25 V; unl. stated
C1038	23-83214C18	15 ±20%; 35 V
C1039	23-83214C07	22 ±20%; 15 V
C1040	23-83214C18	15 ±20%; 35 V
C1041	21-82372C01	0.1 +80-20%; 25 V
C1042	21-82372C02	0.2 +80-20%; 25 V
C1043	21-82187B07	470 pF; 500 V
C1044	23-83214C15	4.7 ±20%; 25 V
C1045	21-82187B14	.001; 100 V
C1046	21-82372C02	0.2 +80-20%; 25 V
C1047	8-83813H34	.033 ±5%; 100 V
C1048	23-83214C29	39; 10 V
C1049	8-83813H34	.033 ±5%; 100 V
C1050	21-82133G77	18 pF ±5%; N150
C1051	21-859943	250 pF ±5%
C1052	8-83514E06	.01 ±5%
C1053	23-83214C15	4.7 ±20%; 25 V
C1054	21-84494B21	650 pF ±5%; 300 V
C1055	23-83214C02	15 ±20%; 25 V
C1056	21-82428B25	.002 ±20%; 500 V
C1057	21-82187B17	820; 500 V
C1058	23-82783B08	1 ±20%; 35 V
C1059	21-83596E21	.01 +80-20%; 200 V
		SEMICONDUCTOR DEVICE, diode: (SEE NOTE)
CR1017, 1018, 1019	48-83654H01	silicon
CR1020	48-83654H01	silicon
CR1021	48-83654H01	silicon
CR1022, 1023, 1024	48-82466H13	silicon
CR1025	48-82256C37	Zener type; 6.8 V; 1 W
CR1026	48-82256C14	Zener type; 15 V
CR1027, 1028	48-82392B03	silicon
CR1029 thru 1042	48-83654H01	silicon
CR1043 thru 1045	48-82392B03	silicon
CR1046	48-82256C56	Zener type; 8.8 V; 1 W
CR1047	48-82256C37	Zener type; 6.8 V; 1 W
		INTEGRATED CIRCUIT:
IC1001	51-84320A02	type M2002
		CONNECTOR, plug:
P1002		consists of 29-84028H01 male single contact; 8 req'd
		TRANSISTOR: (SEE NOTE)
Q1014	48-869642	N-P-N; type M9642
Q1015	48-869568	N-P-N; type M9568
Q1016, 1017, 1018	48-869642	N-P-N; type M9642
Q1019	48-869731	N-P-N; type M9731
Q1020	48-869732	P-N-P; type M9732
Q1021	48-869491	N-P-N; type M9491
Q1022	48-869643	P-N-P; type M9643
Q1023, 1024	48-869642	N-P-N; type M9642
Q1025	48-869643	P-N-P; type M9643
Q1026, 1027, 1028, 1029	48-869642	N-P-N; type M9642
Q1030	48-869643	P-N-P; type M9643
Q1031	48-869491	N-P-N; type M9491
Q1032	48-869390	N-P-N; type M9390
Q1033	48-869642	N-P-N; type M9642
Q1034	48-869643	P-N-P; type M9643
Q1035, 1036	48-869642	N-P-N; type M9642
Q1037	48-869643	P-N-P; type M9643
Q1038	48-869677	P-N-P; type M9677
Q1039	48-869643	P-N-P; type M9643
Q1040	48-869642	N-P-N; type M9642
Q1041	48-869643	P-N-P; type M9643
Q1042	48-869642	N-P-N; type M9642
		RESISTOR, fixed; ±10%; 1/4 W; unl. stated
R1023	6-128685	22k
R1024	6-128902	47k
R1025	6-129226	100k
R1026	6-127806	27k

OR

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
R1027	6-129225	10k
R1028	6-127806	27k
R1029	6-129146	150k
R1030	6-128685	22k
R1031	6-129146	150k
R1032	6-128902	47k
R1033	6-128685	22k
R1034	6-128902	47k
R1035	6-129230	12k
R1036	6-6477	15k
R1037	6-128904	18k
R1038	6-128902	47k
R1039	6-129225	10k
R1040	6-129433	5.6k
R1041	17-82177B31	400; 5 W
R1042	6-131652	39
R1043	6-129775	330
R1044	6-128689	2.2k
R1045	6-127802	1k
R1046	6-129754	33
R1047	6-127804	4.7k
R1048	6-129755	10
R1049	6-128902	47k
R1050	6-83175C56	45.3k; 1 %
R1051	6-128902	47k
R1052	6-84444A18	750; 1%
R1053	6-129755	10
R1054	6-83175C56	45.3; 1%
R1055	6-129147	220k
R1056	6-127804	4.7k
R1057	6-128902	47k
R1058	6-129754	33
R1059	6-127804	4.7k
R1060	6-128904	18k
R1061	6-127802	1k
R1062	6-129755	10
R1063	6-128904	18k
R1064	6-129225	10k
R1065	6-131525	270 ±5%
R1066	6-83175C85	5.76k ±1%
R1067	6-128685	22k
R1068	6-127802	1k
R1069	6-127800	220
R1070	6-129224	82
R1071, 1072	6-127803	1.5k
R1073	6-127800	220
R1074	6-129231	3.3k
R1075	6-127805	15k
R1076	6-127802	1k
R1077	6-127805	15k
R1078	6-127802	1k
R1079	6-129144	68k
R1080	6-128687	6.8k
R1081	6-6480	22k
R1082	6-129775	330
R1083	6-128685	22k
R1084	6-128685	22k
R1085	6-129225	10k
R1086	6-128685	22k
R1087	6-129617	120
R1088	6-124A07	18 ±5%
R1089	6-124A07	18 ±5%
R1090	6-129775	1082
R1091	18-83083G14	var: 1k
R1092, 1093	6-127802	1k
R1094	6-129231	3.3k
R1095	6-129225	10k
R1096	6-129806	330 ±5%
R1097, 1098	51-84312B83	module, 1k (also R1104 & R1105)
R1099	6-127802	1k
R1100	6-127803	1.5k
R1101	6-129753	100
R1102	18-83083G14	var: 1k
R1103	6-129753	100
R1104, 1105	51-84312B83	module, 1k (also R1097 & R1098)
R1106	6-128903	39k
R1107	6-128685	22k
R1108	6-127801	470
NON-REFERENCED ITEMS		
	42-84228B01	RETAINER, 8 req'd
	5-84500B01	EYELET, special, 4 req'd
	55-84300B01	HANDLE

LA O.	DESCRIPTION
	TRANSFORMER:
D01	Pri: BLK, BLK; res. 0.354 ohm
	Sec: RED, RED; res. .062 ohm
	CABLE:
C01	AC line cord; includes refer P1001
	FUSEHOLDER:
01	panel mounting
D01	terminal
01	panel mounting
RENCED ITEMS	
D01	SPACER, 2 req'd
D01	SHIELD, choke, L1001
D01	COVER, choke; L1001
H01	RETAINER, line cord
D02	PLATE, cover pwr
	GROMMET, rubber, 2 req'd
D01	HEAT EXCHANGER
11	WASHER, shoulder
	LOCKSCREW; (8-32 x 3/8) plain hex; 7 req'd
A01	INSULATOR, mica; 3 req'd
D08	CLAMP, 7/16"
D03	CLAMP, 3/8"
C02	CLAMP, 1/4" nylon
01	HEAT SINK
01	SOCKET, transistor; Q1003, 1004, 1005
C01	SOCKET, capacitor; C1006, 1007, 1008, 1009, 1012, 1013

ABLE KIT

Cable Kit PL-1668-O

	RECEPTACLE, plug: includes 14-84590B01 PLUG 9-84151B01 female; contacts; 5 req'd

+9.6 V REGULATOR BOARD

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
TLN4732A +9.6 V Regulator Board		PL-1670-O
		CAPACITOR, fixed: uF
C1028	21-82428B25	.002 ±20%; 500 V
C1029	21-82428B36	.002 ±20%; 200 V
C1030	21-82372C04	.05 +80-20%; 25 V
C1031	23-82601A09	100 +150-10%; 25 V
		SEMICONDUCTOR DEVICE, diode: SEE NOTE
CR1009, 1010	48-82392B03	silicon
CR1011	48-82256C16	Zener type; 8.2 V
		TRANSISTOR: SEE NOTE
Q1006	48-869701	P-N-P; type M9701
Q1007	48-869491	N-P-N; type M9491
Q1008	48-869642	N-P-N; type M9642
		RESISTOR, fixed; ±10%; 1/4 W; unl. stated
R1015	6-6229	1k; 1/2 W
R1016	6-6390	180; 1 W
R1017	6-129860	56
R1018	6-131377	15
NON-REFERENCED ITEMS		
	14-83575A01	INSULATOR, transistor
	9-83662A01	SOCKET, transistor; Q1006

+13.8 V REGULATOR BOARD

PARTS LIST

TLN4733A +13.8 V Regulator Board
(Remote Control Applications) PL-1671-B

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
		CAPACITOR, fixed: uF ±10%; 25 V; unl. stated
C1038	23-83214C18	15 ±20%; 35 V
C1039	23-83214C07	22 ±20%; 15 V
C1040	23-83214C18	15 ±20%; 35 V
C1041	21-82372C01	0.1 +80-20%; 25 V
C1042	21-82372C02	0.2 +80-20%; 25 V
C1043	21-82187B07	470 pF; 500 V
C1044	23-83214C15	4.7 ±20%; 25 V
C1045	21-82187B14	.001; 100 V
C1046	21-82372C02	0.2 +80-20%; 25 V
C1047	8-83813H34	.033 ±5%; 100 V
C1048	23-83214C29	39; 10 V
C1049	8-83813H34	.033 ±5%; 100 V
C1050	21-82133G77	18 pF ±5%; N150
C1051	21-859943	250 pF ±5%
C1052	8-83514E06	.01 ±5%
C1053	23-83214C15	4.7 ±20%; 25 V
C1054	21-84494B21	650 pF ±5%; 300 V
C1055	23-83214C02	15 ±20%; 25 V
C1056	21-82428B25	.002 ±20%; 500 V
C1057	21-82187B17	820; 500 V
C1058	23-82783B08	1 ±20%; 35 V
C1059	21-83596E21	.01 +80-20%; 200 V
		SEMICONDUCTOR DEVICE, diode: (SEE NOTE)
CR1017, 1018, 1019	48-83654H01	silicon
CR1022, 1023, 1024	48-82466H13	silicon
CR1025	48-82256C37	Zener type; 6.8 V; 1 W
CR1026	48-82256C14	Zener type; 15 V
CR1027, 1028	48-82392B03	silicon
CR1029 thru 1042	48-83654H01	silicon
CR1043 thru 1045	48-82392B03	silicon
CR1046	48-82256C56	Zener type; 8.8 V, 1 W
CR1047	48-82256C37	Zener type; 6.8 V, 1 W
		INTEGRATED CIRCUIT
IC1001	51-84320A02	type M2002
		CONNECTOR, plug:
P1002		consists of 29-84028H01 male single contact; 8 req'd
		TRANSISTOR: (SEE NOTE)
Q1014	48-869642	N-P-N; type M9642
Q1016, 1017, 1018	48-869642	N-P-N; type M9642
Q1019	48-869731	N-P-N; type M9731
Q1020	48-869732	P-N-P; type M9732
Q1021	48-869491	N-P-N; type M9491
Q1022	48-869643	P-N-P; type M9643
Q1023, 1024	48-869642	N-P-N; type M9642
Q1025	48-869643	P-N-P; type M9643
Q1026, 1027, 1028, 1029	48-869642	N-P-N; type M9642
Q1030	48-869643	P-N-P; type M9643
Q1031	48-869491	N-P-N; type M9491
Q1032	48-869390	N-P-N; type M9390
Q1033	48-869642	N-P-N; type M9642
Q1034	48-869643	P-N-P; type M9643
Q1035, 1036	48-869642	N-P-N; type M9642
Q1037	48-869643	P-N-P; type M9643
Q1038	48-869677	P-N-P; type M9677
Q1039	48-869643	P-N-P; type M9643
Q1040	48-869642	N-P-N; type M9642
Q1041	48-869643	P-N-P; type M9643
Q1042	48-869642	N-P-N; type M9642
		RESISTOR, fixed; ±10%; 1/4 W; unl. stated
R1023	6-128685	22k
R1024	6-128902	47k
R1025	6-129226	100k
R1029	6-129146	150k
R1030	6-128685	22k
R1031	6-129146	150k
R1032	6-128902	47k
R1033	6-128685	22k
R1034	6-128902	47k
R1035	6-129230	12k
R1036	6-6477	15k
R1037	6-128904	18k
R1038	6-128902	47k
R1039	6-129225	10k
R1040	6-129433	5.6k
R1041	17-82177B31	400; 5 W
R1042	6-131652	39
R1043	6-129775	330
R1044	6-128689	2.2k
R1045	6-127802	1k
R1046	6-129754	33
R1047	6-127804	4.7k
R1048	6-129755	10
R1049	6-128902	47k
R1050	6-83175C56	45.3k; 1%
R1051	6-128902	47k
R1052	6-84444A18	750; 1%
R1053	6-129755	10
R1054	6-83175C56	45.3; 1%
R1055	6-129147	220k
R1056	6-127804	4.7k
R1057	6-128902	47k
R1058	6-129754	33
R1059	6-127804	4.7k
R1060	6-128904	18k
R1061	6-127802	1k
R1062	6-129755	10
R1063	6-128904	18k
R1064	6-129225	10k
R1065	6-131525	270 ±5%
R1066	6-83175C85	5.76k ±1%
R1067	6-128685	22k
R1068	6-127802	1k
R1069	6-127800	220
R1070	6-129224	82
R1071, 1072	6-127803	1.5k
R1073	6-127800	220
R1074	6-129231	3.3k
R1075	6-127805	15k
R1076	6-127802	1k
R1077	6-127805	15k
R1078	6-127802	1k
R1079	6-129144	68k
R1080	6-128687	6.8k
R1081	6-6480	22k
R1082	6-129775	330
R1083	6-128685	22k
R1084	6-128685	22k
R1085	6-129225	10k
R1086	6-128685	22k
R1087	6-129617	120
R1088	6-124A07	18 ±5%
R1089	6-124A07	18 ±5%
R1090	6-129775	1082
R1091	18-83083G14	var: 1k
R1092, 1093	6-127802	1k
R1094	6-129231	3.3k
R1095	6-129225	10k
R1096	6-129806	330 ±5%
R1097, 1098	51-84312B83	module, 1k (also R1104 & R1105)
R1099	6-127802	1k
R1100	6-127803	1.5k
R1101	6-129753	100
R1102	18-83083G14	var: 1k
R1103	6-129753	100
R1104, 1105	51-84312B83	module, 1k (also R1097 & R1098)
R1106	6-128903	39k
R1107	6-128685	22k
R1108	6-127801	470
		NON-REFERENCED ITEMS
	42-84228B01	RETAINER; 8 req'd
	5-84500B01	EYELET, special; 4 req'd
	55-84300B01	HANDLE
	1-80727B85	includes 84-84381D01 circuit board; refer part P1002

OR

TLN4936A +13.8 V Regulator Board
(Local Control Applications) PL-1674-B

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
		CAPACITOR, fixed; uF ±10%; 25 V; unl. stated
C1038	23-83214C18	15 ±20%; 35 V
C1039	23-83214C07	22 ±20%; 15 V
C1040	23-83214C18	15 ±20%; 35 V
C1041	21-82372C01	0.1 +80-20%; 25 V
C1042	21-82372C02	0.2 +80-20%; 25 V
C1043	21-82187B07	470 pF; 500 V
C1044	23-83214C15	4.7 ±20%; 25 V
C1045	21-82187B14	.001; 100 V
C1046	21-82372C02	0.2 +80-20%; 25 V
C1047	8-83813H34	.033 ±5%; 100 V
C1048	23-83214C29	39; 10 V
C1049	8-83813H34	.033 ±5%; 100 V
C1050	21-82133G77	18 pF ±5%; N150
C1051	21-859943	250 pF ±5%
C1052	8-83514E06	.01 ±5%
C1053	23-83214C15	4.7 ±20%; 25 V
C1054	21-84494B21	650 pF ±5%; 300 V
C1055	23-83214C02	15 ±20%; 25 V
C1056	21-82428B25	.002 ±20%; 500 V
C1057	21-82187B17	820; 500 V
C1058	23-82783B08	1 ±20%; 35 V
C1059	21-83596E21	.01 +80-20%; 200 V
		SEMICONDUCTOR DEVICE, diode: (SEE NOTE)
CR1017, 1018, 1019	48-83654H01	silicon
CR1020	48-83654H01	silicon
CR1021	48-83654H01	silicon
CR1022, 1023, 1024	48-82466H13	silicon
CR1025	48-82256C37	Zener type; 6.8 V; 1 W
CR1026	48-82256C14	Zener type; 15 V
CR1027, 1028	48-82392B03	silicon
CR1029 thru 1042	48-83654H01	silicon
CR1043 thru 1045	48-82392B03	silicon
CR1046	48-82256C56	Zener type; 8.8 V; 1 W
CR1047	48-82256C37	Zener type; 6.8 V; 1 W
		INTEGRATED CIRCUIT: type M2002
IC1001	51-84320A02	
		CONNECTOR, plug:
P1002		consists of 29-84028H01 male single contact; 8 req'd
		TRANSISTOR: (SEE NOTE)
Q1014	48-869642	N-P-N; type M9642
Q1015	48-869568	N-P-N; type M9568
Q1016, 1017, 1018	48-869642	N-P-N; type M9642
Q1019	48-869731	N-P-N; type M9731
Q1020	48-869732	P-N-P; type M9732
Q1021	48-869491	N-P-N; type M9491
Q1022	48-869643	P-N-P; type M9643
Q1023, 1024	48-869642	N-P-N; type M9642
Q1025	48-869643	P-N-P; type M9643
Q1026, 1027, 1028, 1029	48-869642	N-P-N; type M9642
Q1030	48-869643	P-N-P; type M9643
Q1031	48-869491	N-P-N; type M9491
Q1032	48-869390	N-P-N; type M9390
Q1033	48-869642	N-P-N; type M9642
Q1034	48-869643	P-N-P; type M9643
Q1035, 1036	48-869642	N-P-N; type M9642
Q1037	48-869643	P-N-P; type M9643
Q1038	48-869677	P-N-P; type M9677
Q1039	48-869643	P-N-P; type M9643
Q1040	48-869642	N-P-N; type M9642
Q1041	48-869643	P-N-P; type M9643
Q1042	48-869642	N-P-N; type M9642
		RESISTOR, fixed; ±10%; 1/4 W; unl. stated
R1023	6-128685	22k
R1024	6-128902	47k
R1025	6-129226	100k
R1026	6-127806	27k
R1027	6-129225	10k
R1028	6-127806	27k
R1029	6-129146	150k
R1030	6-128685	22k
R1031	6-129146	150k
R1032	6-128902	47k
R1033	6-128685	22k
R1034	6-128902	47k
R1035	6-129230	12k
R1036	6-6477	15k
R1037	6-128904	18k
R1038	6-128902	47k
R1039	6-129225	10k
R1040	6-129433	5.6k
R1041	17-82177B31	400; 5 W
R1042	6-131652	39
R1043	6-129775	330
R1044	6-128689	2.2k
R1045	6-127802	1k
R1046	6-129754	33
R1047	6-127804	4.7k
R1048	6-129755	10
R1049	6-128902	47k
R1050	6-83175C56	45.3k; 1 %
R1051	6-128902	47k
R1052	6-84444A18	750; 1%
R1053	6-129755	10
R1054	6-83175C56	45.3; 1%
R1055	6-129147	220k
R1056	6-127804	4.7k
R1057	6-128902	47k
R1058	6-129754	33
R1059	6-127804	4.7k
R1060	6-128904	18k
R1061	6-127802	1k
R1062	6-129755	10
R1063	6-128904	18k
R1064	6-129225	10k
R1065	6-131525	270 ±5%
R1066	6-83175C85	5.76k ±1%
R1067	6-128685	22k
R1068	6-127802	1k
R1069	6-127800	220
R1070	6-129224	82
R1071, 1072	6-127803	1.5k
R1073	6-127800	220
R1074	6-129231	3.3k
R1075	6-127805	15k
R1076	6-127802	1k
R1077	6-127805	15k
R1078	6-127802	1k
R1079	6-129144	68k
R1080	6-128687	6.8k
R1081	6-6480	22k
R1082	6-129775	330
R1083	6-128685	22k
R1084	6-128685	22k
R1085	6-129225	10k
R1086	6-128685	22k
R1087	6-129617	120
R1088	6-124A07	18 ±5%
R1089	6-124A07	18 ±5%
R1090	6-129775	1082
R1091	18-83083G14	var: 1k
R1092, 1093	6-127802	1k
R1094	6-129231	3.3k
R1095	6-129225	10k
R1096	6-129806	330 ±5%
R1097, 1098	51-84312B83	module, 1k (also R1104 & R1105)
R1099	6-127802	1k
R1100	6-127803	1.5k
R1101	6-129753	100
R1102	18-83083G14	var: 1k
R1103	6-129753	100
R1104, 1105	51-84312B83	module, 1k (also R1097 & R1098)
R1106	6-128903	39k
R1107	6-128685	22k
R1108	6-127801	470
		NON-REFERENCED ITEMS
	42-84228B01	RETAINER, 8 req'd
	5-84500B01	EYELET, special, 4 req'd
	55-84300B01	HANDLE

POWER SUPPLY CHASSIS

TLN4734A Power Supply Chassis
(Continuous Duty, Remote Control Applications) PL-1672-A

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
		CAPACITOR, fixed: uF
C1001 thru 1005	21-83596E16	.02 +80-20%; 2000 V
C1006 thru 1009	23-83093G21	2000 +100-10%; 100 V
C1010	21-82187B14	.001; 100 V
C1011	21-82372C02	0.2 +80-20%; 25 V
C1012, 1013	23-83093G20	17 500 +150-10%; 20 V
C1015, 1016	21-84211B01	.01; GMV; 250 V
C1017	23-83093G20	17 500 +150-10%; 20 V
C1018	8-82317B01	0.1; 100 V
C1019	8-82317B01	.01; 100 V
C1020 thru 1024	21-84211B01	.01; GMV; 250 V
C1025	23-83210A19	500 +100-10%; 20 V
C1026, 1027	21-84211B01	.01; GMV; 250 V
C1032, 1033	21-84211B01	.01; GMV; 250 V
1034		
		SEMICONDUCTOR DEVICE, diode: (SEE NOTE)
CR1001	48-82732C09	silicon; MR324R
CR1002	48-82732C08	silicon; MR324R
CR1003	48-82732C09	silicon; MR324R
CR1004, 1005, 1006	48-82732C08	silicon; MR324R
CR1007	48-82732C13	silicon; type (MR891R)
CR1008	48-82732C13	silicon; type (MR891R)
		SURGE VOLTAGE PROTECTION: spark gap
E1001	80-84660D01	
		FUSE:
F1001	65-139131	15 amp
F1002	65-41492	30 amp
F1003, 1004	65-61688	4 amp
		CONNECTOR, receptacle: female; 3 contact
J1001	9-83238C01	includes: 84-84590A01 Circuit
J1002	1-80728B54	board, 9-83011H01 female; single contact, 8 req'd
		COIL:
L1001	25-84458D01	choke, 500 uH
L1002	24-84407E01	choke, 5 uH
L1003	24-84408E01	choke, 5 uH
L1004	24-82606B01	choke, 125 uH
P1001		CONNECTOR, plug: Part of W1001
		TRANSISTOR: (SEE NOTE)
Q1001, 1002	48-869715	N-P-N; type M9715
Q1003, 1004	48-869714	P-N-P; type M9714
Q1005	48-869729	N-P-N; type M9729
		RESISTOR, fixed: ±10%, 1/2 W; unl. stated
R1001	6-5765	5.6k; 2 W
R1002	6-127802	1k; 1/4 W
R1003, 1004	6-5621	10
R1005	17-890467	.33
R1006, 1007	17-82036G13	.75 ±5%; 2 W
R1008	6-488033	10; 2 W
R1009	17-890467	.33
R1010	6-488033	10; 2 W
R1011	17-82177B20	50; 10 W
R1012	17-85492	9 ±5%
R1013	6-84449D02	.002
R1018	6-84232B02	shunt, resistor
		VARISTOR: transient voltage suppressor
RV1001	6-84661D01	
		SEMICONDUCTOR DEVICE, diode: (SEE NOTE)
SCR1001	48-84973C01	silicon controlled diode

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
		TRANSFORMER: Pri: BLK, BLK; res. 0.20 ohm Sec: RED, RED; res. 0.24 ohm
T1001	25-84455D02	
		CABLE: AC line cord; includes refer P1001
W1001	30-83211C01	
		FUSEHOLDER: panel mounting terminal panel mounting
XF1001	9-82083C01	
XF1002	31-84599D01	
XF1003, 1004	9-82083C01	
NON-REFERENCED ITEMS		
	43-84608D01	SPACER, 2 req'd
	26-84335D01	SHIELD, choke, L1001
	15-84334D01	COVER, choke; L1001
	42-82018H01	RETAINER, line cord
	64-84340D02	PLATE, cover pwr
	37-85556	GROMMET, rubber; 2 req'd
	26-84470D01	HEAT EXCHANGER
	4-82345A11	WASHER, shoulder
	3-840892	LOCKSCREW, (8-32 x 3/8) plain hex, 7 req'd
	14-83575A01	INSULATOR, mica; 3 req'd
	42-82387D08	CLAMP, 7/16"
	42-82387D03	CLAMP, 3/8"
	42-82143C02	CLAMP, 1/4" nylon
	7-83959A01	HEAT SINK
	9-83662A01	SOCKET, transistor; Q1003, 1004, 1005
	14-84037C01	SOCKET, capacitor; C1006, 1007, 1008, 1009, 1012, 1013

OR

TLN4731A Power Supply Chassis
(Intermittent Duty, Remote Control Applications) PL-1669-B

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
		CAPACITOR, fixed: uF ±10%; unl. stated
C1001 thru 1005	21-83596E16	.02 +80-20%; 2000 V
C1006 thru 1009	23-83093G21	2000 +100-10%; 100 V
C1010	21-82187B14	.001; 100 V
C1011	21-82372C02	0.2 +80-20%; 25 V
C1012, 1013	23-83093G20	17 500 +150-10%; 20 V
C1015, 1016	21-84211B01	.01; GMV; 250 V
C1017	8-82317B01	0.1; 100 V
C1018	23-83093G20	17 500 +150-10%; 20 V
C1019	8-82317B01	.01; 100 V
C1020 thru 1024	21-84211B01	.01; GMV; 250 V
C1025	23-83210A19	500 +100-10%; 20 V
C1026, 1027	21-84211B01	.01; GMV; 250 V
C1032, 1033	21-84211B01	.01; GMV; 250 V
1034		
C1035	21-83596E16	.02 +80-20%; 200 V
		SEMICONDUCTOR DEVICE, diode: (SEE NOTE)
CR1001	48-82732C09	silicon; MR324R
CR1002	48-82732C08	silicon; MR324R
CR1003	48-82732C09	silicon; MR324R
CR1004, 1005, 1006	48-82732C08	silicon; MR324R
CR1008	48-82732C13	silicon; MR891R
		SURGE VOLTAGE PROTECTOR: spark gap
E1001	80-84660D01	
		FUSE:
F1001	65-139131	15 amp
F1002	65-41492	30 amp
F1003, 1004	65-61688	4 amp
		CONNECTOR, receptacle: female; 3 contact
J1001	9-83238C01	includes 84-84590A01 circuit
J1002	1-80728B54	board, 9-83011H01 female; single contact, 8 req'd
		COIL:
L1001	25-84458D01	choke, 500 uH
L1002	24-84407E01	choke, 5 uH
L1003	24-84408E01	choke, 5 uH
L1004	24-82606B01	choke, 125 uH
P1001		CONNECTOR, plug: Part of W1001
		TRANSISTOR: (SEE NOTE)
Q1001, 1002	48-869715	N-P-N; type M9715
Q1003, 1004	48-869714	P-N-P; type M9714
Q1005	48-869729	N-P-N; type M9729
		RESISTOR, fixed: ±10%; 1/2 W; unl. stated
R1001	6-5765	5.6k; 2 W
R1002	6-127802	1k; 1/4 W
R1003, 1004	6-5621	10
R1005	17-890467	.33
R1006, 1007	17-82036G13	.75 ±5%; 2 W
R1008	6-488033	10; 2 W
R1009	17-890467	.33
R1010	6-488033	10; 2 W
R1011	17-82177B20	50; 10 W
R1012	17-85492	9 ±5%
R1013, 1014	6-84449D02	.002
R1018	6-84232B02	shunt, resistor
		VARISTOR: transient voltage suppressor
RV1001	6-84661D01	
		SEMICONDUCTOR DEVICE, diode: (SEE NOTE)
SCR1001	48-84973C01	silicon controlled diode

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
		TRANSFORMER: Pri: BLK, BLK; res. 0.354 ohm Sec: RED, RED; res. .062 ohm
T1001	25-84455D01	
		CABLE: AC line cord; includes refer P1001
W1001	30-83211C01	
		FUSEHOLDER: panel mounting terminal panel mounting
XF1001	9-82083C01	
XF1002	31-84599D01	
XF1003, 1004	9-82083C01	
NON-REFERENCED ITEMS		
	43-84608D01	SPACER; 2 req'd
	26-84335D01	SHIELD, choke, L1001
	15-84334D01	COVER, choke, L1001
	42-82018H01	RETAINER, line cord
	64-84340D02	PLATE, cover pwr
	37-85556	GROMMET, rubber, 2 req'd
	26-84470D01	HEATEXCHANGER
	4-82345A11	WASHER, shoulder
	3-840892	LOCKSCREW, (8-32 x 3/8) plain hex; 7 req'd
	14-83575A01	INSULATOR, mica; 3 req'd
	42-82387D08	CLAMP, 7/16"
	42-82387D03	CLAMP, 3/8"
	42-82143C02	CLAMP, 1/4" nylon
	7-83959A01	HEAT SINK
	9-83662A01	SOCKET, transistor; Q1003, 1004, 1005
	14-84037C01	SOCKET, capacitor; C1006, 1007, 1008, 1009, 1012, 1013

OR

TLN4935A Power Supply Chassis
(Intermittent Duty, Local Control Applications) PL-1673-A

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
		CAPACITOR, fixed: uF ±10%; unl. stated
C1001 thru 1005	21-83596E16	.02 +80-20%; 2000 V
C1006 thru 1009	23-83093G21	2000 +100-10%; 100 V
C1010	21-82187B14	.001; 100 V
C1011	21-82372C02	0.2 +80-20%; 25 V
C1012, 1013	23-83093G20	17 500 +150-10%; 20 V
C1015, 1016	21-84211B01	.01; GMV; 250 V
C1017	8-82317B01	0.1; 100 V
C1018	23-83093G20	17 500 +150-10%; 20 V
C1019	8-82317B01	.01; 100 V
C1020 thru 1024	21-84211B01	.01; GMV; 250 V
C1025	23-83210A19	500 +100-10%; 20 V
C1026, 1027	21-84211B01	.01; GMV; 250 V
C1032, 1033	21-84211B01	.01; GMV; 250 V
1034		
		SEMICONDUCTOR DEVICE, diode: (SEE NOTE)
CR1001	48-82732C09	silicon; MR324R
CR1002	48-82732C08	silicon; MR324R
CR1003	48-82732C09	silicon; MR324R
CR1004, 1006	48-82732C08	silicon; MR324R
CR1008	48-82732C13	silicon; MR891R
		SURGE VOLTAGE PROTECTOR: spark gap
E1001	80-84660D01	
		FUSE:
F1001	65-139131	15 amp
F1002	65-41492	30 amp
F1003, 1004	65-61688	4 amp
		CONNECTOR, receptacle: female; 3 contact
J1001	9-83238C01	includes 84-84590A01 circuit
J1002	1-80728B54	board, 9-83011H01 female; single contact, 8 req'd
		COIL:
L1001	25-84458D01	choke, 500 uH
L1002	24-84407E01	choke, 5 uH
L1003	24-84408E01	choke, 5 uH
L1004	24-82606B01	choke, 125 uH
P1001		CONNECTOR, plug: Part of W1001
		TRANSISTOR: (SEE NOTE)
Q1001, 1002	48-869715	N-P-N; type M9715
Q1003, 1004	48-869714	P-N-P; type M9714
Q1005	48-869729	N-P-N; type M9729
		RESISTOR, fixed: ±10%; 1/2 W; unl. stated
R1001	6-5765	5.6k; 2 W
R1002	6-127802	1k, 1/4 W
R1003, 1004	6-5621	10
R1005	17-890467	.33
R1006, 1007	17-82036G13	.75 ±5%; 2 W
R1008	6-488033	10; 2 W
R1009	17-890467	.33
R1010	6-488033	10; 2 W
R1011	17-82177B20	50; 10 W
R1012	17-85492	9 ±5%
R1013	6-84449D02	.002
R1018	6-84232B02	shunt, resistor
		VARISTOR: transient voltage suppressor
RV1001	6-84661D01	
		SEMICONDUCTOR DEVICE, diode: (SEE NOTE)
SCR1001	48-84973C01	silicon controlled diode

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
		TRANSFORMER: Pri: BLK, BLK; res. 0.354 ohm Sec: RED, RED; res. .062 ohm
T1001	25-84455D01	
		CABLE: AC line cord; includes refer P1001
W1001	30-83211C01	
		FUSEHOLDER: panel mounting terminal panel mounting
XF1001	9-82083C01	
XF1002	31-84599D01	
XF1003, 1004	9-82083C01	
NON-REFERENCED ITEMS		
	43-84608D01	SPACER, 2 req'd
	26-84335D01	SHIELD, choke, L1001
	15-84334D01	COVER, choke; L1001
	42-82018H01	RETAINER, line cord
	64-84340D02	PLATE, cover pwr
	37-85556	GROMMET, rubber, 2 req'd
	26-84470D01	HEAT EXCHANGER
	4-82345A11	WASHER, shoulder
	3-840892	LOCKSCREW, (8-32 x 3/8) plain hex; 7 req'd
	14-83575A01	INSULATOR, mica; 3 req'd
	42-82387D08	CLAMP, 7/16"
	42-82387D03	CLAMP, 3/8"
	42-82143C02	CLAMP, 1/4" nylon
	7-83949A01	HEAT SINK
	9-83662A01	SOCKET, transistor; Q1003, 1004, 1005
	14-84037C01	SOCKET, capacitor; C1006, 1007, 1008, 1009, 1012, 1013

CABLE KIT

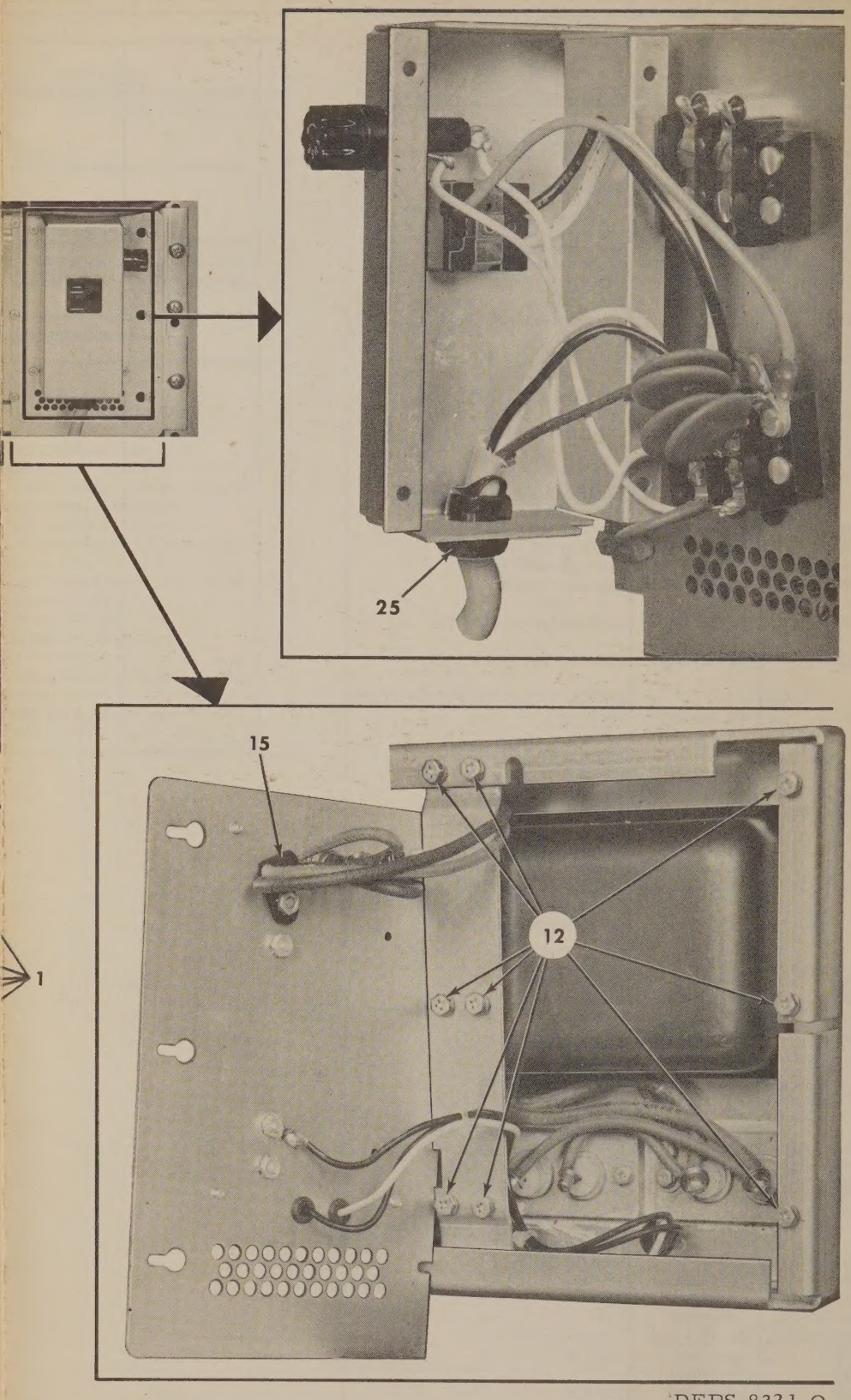
TKN6565A Power Supply Cable Kit PL-1668-O

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
P1003		RECEPTACLE, plug: includes 14-84590B01 PLUG 9-84151B01 female; contacts; 9 req'd

+9.6 V REGULATOR BOARD

TLN4732A +9.6 V Regulator Board PL-1670-O

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
		CAPACITOR, fixed: uF
C1028	21-82428B25	.002 ±20%; 500 V
C1029	21-82428B36	.002 ±20%; 200 V
C1030	21-82372C06	.05 +80-20%; 25 V
C1031	23-82601A09	100 +150-10%; 25 V
		SEMICONDUCTOR DEVICE, diode: SEE NOTE
CR1009, 1010	48-82392R03	silicon
CR1011	48-82256C16	Zener type; 8.2 V
		TRANSISTOR: SEE NOTE
Q1006	48-869701	P-N-P; type M9701
Q1007	48-869491	N-P-N; type M9491
Q1008	48-869642	N-P-N; type M9642
		RESISTOR, fixed; ±10%; 1/4 W; unl. stated
R1015	6-6229	1k; 1/2 W
R1016	6-6390	180; 1 W
R1017	6-129860	56
R1018	6-131377	15
NON-REFERENCED ITEMS		
	14-83575A01	INSULATOR, transistor
	9-83662A01	SOCKET, transistor; Q1006



DEPS-8321-O

CODE	MOTOROLA PART NO.	DESCRIPTION
1	3-134169	SCREW, tapping: 4-40 x 1/4" Fillister hex head with external type lockwasher
2	15-84334D01	COVER SHIELD
3	3-124444	SCREW, machine: 6-32 x 1" plain hex head with external type lockwasher
4	3-3398	SCREW, tapping: 6-32 x 3/8" plain hex head with external type lockwasher
5	26-84470D01	RADIATOR, heat sink
6	3-122318	SCREW, tapping: 6-32 x 5/16" plain hex head with external type lockwasher
7	37-802943	GROMMET, rubber
8	15-84666D01	COVER, "VDR"
9	3-134294	SCREW, tapping: 6-32 x 3/8" plain hex head with external type lockwasher
10	4-7587	WASHER, flat
11	42-82387D08	CLAMP, plastic
12	3-136138	SCREW, tapping: 6-32 x 3/8" plain hex head with external type lockwasher
13	15-84338D01	COVER (low current & 9.6 V filter)
14	15-84338D02	COVER (high current filter)
15	42-82143C02	CLAMP, "nylon": 1/4"
16	3-134184	SCREW, tapping: 4-40 x 5/16" plain hex head with external type lockwasher
17	55-84300B01	HANDLE, circuit board
18	2-7005	NUT, machine: 6-32 x 1/4" hex
19	4-7569	WASHER, flat
20	4-823454.11	WASHER, shoulder
21	29-845081	LUG, ring-tongue
22	29-3006	LUG, double-ended
23	3-129892	NUT, machine: 8-32 x 5/16" hex with external type lockwasher
24	4-8213	WASHER, flat
25	42-82018H01	RETAINER, line cord